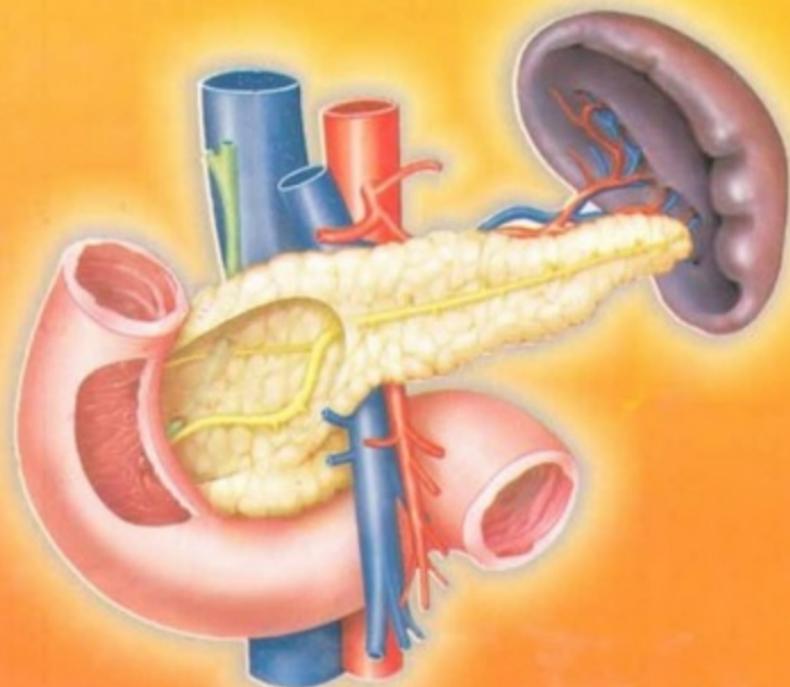


# CONCEPT OF AGNI IN ĀYURVEDA

WITH SPECIAL REFERENCE TO  
AGNIBALA PARIKṢĀ



VD. BHAGWAN DASH



THE  
CHOWKHAMBA SANSKRIT STUDIES  
VOL. LXXXI

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BY  
Vd. BHAGWAN DASH



THE  
CHOWKHAMBA SANSKRIT SERIES OFFICE  
VARANASI-1 ( India )  
1971

*Indological Truths*

Publisher : The Chowkhamba Sanskrit Series Office, Varanasi-1  
Printer : Vidyavilas Press, Varanasi-1  
Edition : First, 1971.

© The Chowkhamba Sanskrit Series Office  
Publishers and Oriental & Foreign Book-Sellers  
K. 37/99, Gopal Mandir Lane  
P. O. CHOWKHAMBA, P. BOX 8, VARANASI-1 ( India )  
Phone : 63145

## P R E F A C E

The thesis on the Concept of *Agni* in *Āyurveda* with Special Reference to *Agnibala-parikṣā* was one of the nine I had to personally guide and direct when I was working as the Professor of *Kāyacikitsā* at the Post Graduate Training Centre in Ayurveda, Jamnagar. This thesis was ranked first by the eminent adjudicators to whom it was referred. The present publication of it in the form of a book involving some minor changes is meant to provide carefully assessed and critically evaluated data gathered by Shri Bhagwan Dash for the benefit of teachers, Post-Graduate students and Research workers in the field of *Āyurveda*.

Recent researches in the history of the evolution of medicine in India have shown that by about the third millennium B. C., the medical knowledge had reached its apogee and crystallised into broad based generalizations, positive concepts and principles. There is evidence to show that these concepts and principles represented a high stage of development of medicine at that time. It is recognized today that *Āyurveda* itself was the outcome of changes of an evolving society. Accordingly, many practices were susceptible to modifications or changes in keeping with the needs of growing urban community. However, the savants of *Āyurveda* took care to enunciate some of the basic concepts and principles in such a manner as to enable their application at all times, regardless of the changes in the social, environmental and other conditions. It is thus seen that, both *Agniveśa* and *Vāgbhaṭa* laid emphasis on ten important factors that may have to be examined before arriving at a diagnosis and the determination of the line of treatment in any given disease, regardless of whether they have been described in the classical text or not. The ten factors referred to above are: *prakṛti*,

*vikṛti, sōra, samhanana, pramāṇa, sātmya, sattva, ahāraśakti, vyāyāmaśakti and vayas*—cf. *Caraka* : *Vimāna* 8 : 94. (According to Vāgbhaṭa, these ten factors are *dūṣya, deśa, bala, kāla, anala, prakṛti, vayas, sattva, sātmya* and *ahāra*—cf. *Aṣṭāṅgahṛdaya* : *Sūtra* 12 : 67–68). It is seen from the discussion recorded in the texts that these factors should invariably be examined both subjectively and objectively. It is, however, seen that the extant editions of the *Saṁhitā-granthas* have neither described nor indicated the methods and techniques for carrying out critical investigations of these factors, except for stating, for example, that the status of the *agni* should be examined with reference to its power to digest and metabolise foods ingested (*agnim jarāpaśaktyā parikṣeta*) and the strength by ones ability to work, i.e. exercise (*balam vyāyāmaśaktyā parikṣeta*). It is difficult to believe that the authors of the classical texts would have deliberately ignored the methods and techniques of the examination of these ten factors. The only inference that could be drawn is that either the methods and techniques were imparted by the teacher to the taught orally or, at some point, in the History of Medicine in India, writings on the methodology and technique were irretrievably lost. In the result, critical examination of the ten factors which included *agni* also became a matter of academic interest and hardly of any practical significance.

This is a grave shortcoming which has to be rectified sooner or later, better sooner than later, if the practice of Āyurveda is to be meaningful, fruitful and rational. It was with a view to remedying this short-coming that Shri Bhagwan Dash selected the *Concept of Agni* in Āyurveda with Special Reference to *Agnibala-parikṣā* for study. His intention in doing so was to bring together all the material relating to the concept of *agni* from different sources, critically evaluate them in the light of advances made by biochemistry in the related fields, and work out methods and techniques for determining the *agni-śakti* and *bala* which can be standardised and applied in practice. His approach has been refreshingly novel, bold and imaginative. In doing so, he built up his hypothesis

exclusively on the basis of references gathered from the classical Ayurvedic texts and commentaries on them. He has put tshi hypothesis to experimental tests, adopting some of the modern biochemical parameters. As a humble student of science, he has not dogmatised his findings but has shown a way and indicated an approach to the problem and suggested that the methods he has worked out may have to be standardised in a large number of cases. This is indeed a valuable contribution and my own share in this work was to guide and bless him in his endeavour which were carefully planned and executed.

I have only to add by the way of a compliment to Shri Bhagwan Dash that he was one of my most exacting students which I believe is one of the best qualifications one can think of a good student.

Dated 22nd May, 1970.

**C. Dwarkanath**



## INTRODUCTION

In the progressive days of Āyurveda, Physicians in this country were the foremost exponents and all round practitioners of their time, teaching and practicing all the eight branches of the Science of Medicine. There is a recorded history that students from all parts of the Globe came to have their under-graduate as well as post-graduate studies in the Medical Faculties of some of the famous Universities of ancient India, namely, Taxila and Nalanda. Due to various reasons State patronage was withdrawn from Āyurveda and transferred to those systems of medicine which were of choice of the then rulers of the country. This led to stagnation, obstructed progress, stunted growth and partial functioning from the affects of which Āyurveda is still suffering.

This period of decadence which can safely be said as the dark age for Āyurveda, has given birth to many misconceptions and often these are incorporated into the texts in various ways. Because of this confusion, one often overlooks the genuine concepts having scientific value and considers them as either wrong or commonsense and this deters him to find out the scientific validity of these statements.

There are many scientific concepts in Āyurveda which need detailed scrutiny to assess their utility in the field of science. The concept of *agni* is one such factor, a study on which is attempted here.

*Agni* is one of the ten factors which are required to be examined before initiating the treatment of a patient. The role of *agni* in the animal body is very much emphasised. It is stated that all internal diseases are caused by the vitiation of this *agni*. This is the pivot round which the remaining factors responsible for the maintenance of health and causation of diseases as well as decay revolve.

Human body is considered in ancient Indian scriptures as a replica of the universe; whatever is available in the universe

they are all represented in the human body, may be in a modified form. The physical *agni* ( fire ) is directly linked up with the biological *agni* inside the human body.

*Sāmkhya*, *Nyāya-Vaiśeṣika* and other systems of natural philosophy deal with the fundamental principles of Āyurveda. It is, impossible to explain or comprehend the biological phenomena described in Āyurveda without having a good background of the material objects enunciated in these ancient philosophical works. In fact a rational explanation of various aspects of *agni* can better be provided if its relation with physical *agni* is elucidated. It is with this in view that in the section-I, *agni* as conceived in the *Sāmkhya* system of philosophy is explained. The *Pariṇāmavāda* which is a logical corolary of *Satkāryavāda* explaining the theory of evolution of the universe provides a rational explanation for the evolution of *rūpatanmātrā* in which *rajas* is patent, *tamas* is latent and *sattva* is sub-latent. It has been shown in the first section that the phenomena of *rajas* or *agni* represented in the forces or motion, radiation, heat, electricity and magnetism are implicit in the concept of and potential in the *rajoguṇa* of *Mūlaprakṛti*.

In the section-II of this work the concept of *agni* as developed in *Nyāya-Vaiśeṣika* system of philosophy is explained. There is striking similarity in the concept of physical *agni* as expounded in this system of philosophy and biological *agni* described in Caraka. *Agni* according to *Nyāya-Vaiśeṣika* is divided into three categories, namely :

- ( i ) *Bhauma* or the physical fire;
- ( ii ) *Divya* or the celestial fire like the lightening, rays of the Sun, Moon and the Stars;
- ( iii ) *Audarya* or the abdominal fire which is responsible for the digestion as well as metabolism and,
- ( iv ) *Ākaraja* which is present in the metals such as gold and silver.

Combination of *agni* with a material object results in various types of transformations. In the *Nyāya-vaiśeṣika*, there

is a rational explanation about the various types of changes, the material objects undergo when they come into contact with *agni* or physical fire. This concept is very relevant inasmuch as it provides some lead about the transformation which the food ingredients undergo in the human body by the reaction of the digestive enzymes which represent the biological *agni*. It has been shown in this section that the matter and energy are separable only up to a certain level beyond which they are inter-changeable and inseparable from each other.

In Section-III the concept of *agni* as developed in Āyurveda is explained. The concept of *agni* is implicit in the concept of *pitta* described in Āyurveda. The roots from which the term *pitta* is derived connote three important aspects of this, namely, it produces heat, it helps in the burning of food and it controls the various psychic factors which facilitate the individual to achieve *siddhis* or spiritual perfection. The relation between *pitta* and *agni* is fully explained in this Section. The physical characteristics and chemical composition of *pitta*, and its mode of formation in the human body are explained with special reference to the data available in the modern biological sciences. The importance of *grahāṇi* as the site of *pittadharākala* has been elaborated. The term *grahāṇi* is generally translated as duodenum, but from the functions, attributed to it in Āyurveda, it can be safely said that the part of the alimentary tract extending from the lower part of stomach to the end of the small intestine should be taken as *grahāṇi*. With a view to illustrate the function of this part of the body, the knowledge available in modern biology is incorporated in this work. Several other organs which help in the function of this *grahāṇi* and linked up by ducts and channels with the duodenum and small intestine, are also described along with their functions. Different states of *agni* are described in Āyurveda. They are *manda* or mild, *tikṣṇa* or aggravated, *viṣama* or irregular and *sama* or balanced. The signs and symptoms of these states of *agni* are described in Āyurveda and during modern times there are certain diseases or disease-syndromes which simulate these states of *agni*. The gastro-intestinal tract has been divided into different

physiological as well as anatomical components. To a person not acquainted with this concept, they may appear to be a contradiction. This point has been elucidated in this section. *Koṣṭha* which represents the gastro-intestinal tract and its various appendages including the organs which are developed from the ectoderm during the process of embryonic development are fully explained.

The process of digestion of food described in āyurveda is based on a slightly different approach inasmuch as the physical state of food after different stages of digestion is taken into consideration and not the chemical transformations. A detailed description of *madhura-bhāva*, *amla-bhāva* and *kaṭu-bhāva*, along with the various important factors which regulate these three stages of digestion are described. Changes which occur in the body because of its coming into contact with various types of digestive enzymes are explained. Apart from the explanation of the digestion in the gastro-intestinal tract, processes of *bhūtāgni-pāka* by which the heterogenous material which come in the form of food to human body becomes homogenous is explained.

Channels which carry the food after digestion have a very important role to play in the physiology of the human body, and the concept of *srotas* specially the role of the liver in the process of digestion has been fully explained. After the food ingredients are made homogenous, the process of synthesis of various types of tissue elements takes place, and for this type of synthesis, a unique concept is envisaged in āyurveda. The role of various types of enzymes which take part in the synthesis of various products and the process by which metabolic equilibrium is maintained are also explained. Different states of *agni* ( digestive enzymes ) directly influence the various events in the human body. A correlation of these two factors incorporating the known knowledge available in modern biology has been brought out.

The product of digestion has to be carried to the stable tissue elements through specific channels. Any obstruction in the channels produces disease and decay in the individual.

Efforts have been made to corroborate the concept of capillary system with that of *dhātu-vaha-srotāni* described in āyurveda. The role of *agni* in the maintenance of metabolic equilibrium and the production of *āma* or the uncooked material in the event of any derangement in this *agni* or metabolic enzymes have been explained. Several psychic events also regulate the production of these enzymes. *Āmadoṣa* is considered in āyurveda to be responsible for the production of all types of internal diseases. Even diseases caused by external agents are actually manifested only when there is production of *āmadoṣa* and subsequent vitiation of *agni* which is present in that locality. The role of *krimis* or germs in the manifestation of diseases has been fully recognized in āyurveda. It has also been described that some of these germs are helpful for the maintenance of human body. This concept appears to be mundane in its outlook. The role of germs in the production of diseases, specially with reference to *āmadoṣa* has been explained. *Āma* or uncooked material may be produced in the gastro-intestinal tract if the local enzymes are deranged. Similarly, *āma* can be produced at the level of the tissues if the enzymes responsible for the synthesis of a particular type of tissue element are deranged. The process by which different types of *āma* are formed both in the gastro-intestinal tract as well as at the level of tissue elements is explained in greater detail.

*Agni*, apart from the digestive function, is also responsible for the production of strength which has two aspects, namely, (1) strength to resist the occurrence of disease and decay in the human body and (2) strength to perform physical exercises. *Bala* or strength is in fact a direct product of the tissue metabolism which produces energy and heat. In Section-IV different methods and different factors from which the strength of *agni* of the individual body can be ascertained are explained and the data available in āyurvedic literature for ascertaining the state of *agni* in the individual's body from outside symptoms with special reference to the constitution of the individual, season, age and other physical signs and symptoms are des-

cribed. Stool or *śakṛt*, is one of the important products of digestion and metabolism. Apart from the refuse of the food ingredients, certain endogenous elements come out through the stool. Any change in the process of metabolism affects the endogenous fraction of the stool resulting in a change in its physical as well as chemical characteristics. An effort has been made to ascertain the state of *agni* inside the human body from various characteristic features of the stool. Some other symptoms which indicate the function of *amāsaya* and *pakvāśaya* have been described. Other symptoms indicating the impairment of the functions of gastro-intestinal tract and *dhātvagni* are also described.

The material and method actually followed to ascertain the strength of *agni*, digestion and metabolism, and *mārisabala* ( physical strength ) are then described. Various criteria fixed in determining these factors and parameters decided for drawing of conclusions are also described.

Special emphasis is then laid upon the determination of the *agni* of different *dhātus*. Diseases produced by the derangement of *agni* of these *dhātus* are then explained specially with reference to those described in modern medicine.

In the discussion that follows, the data collected by experiments on volunteers and patients have been described and the criteria of demarcating an individual as of *pravara-bala*, *madhya-bala* and *avara-bala* are also described.

Because of the centuries of accretions, the theories and concepts we find at present in the works of ancient medicine, are interpreted to be commonsense and not scientific knowledge. It is perhaps necessary to examine the difference between the scientific knowledge, the knowledge of commonsense before the statements including theories and concepts of *āyurveda* could be put in one or the other category. Very generally described, commonsense is the aggregate of views commonly held by a group of people without seriously questioning their bonafide. In other words, commonsense knowledge is the knowledge of the first look, knowledge which is

self evident or obvious to any one who is possessed of normal intellectual powers. Science is designated as trained and organized commonsense. Here lies the subtle difference of profound importance. The essence of science lies in the critical technique which is lacking in commonsense. The scientific knowledge is much more rigorously controlled. It is more penetrating in its analysis, more far-reaching in its scope and more carefully guarded in its evaluations and interpretations.

Examined with the above parameters, concepts and theories of āyurveda are scientific except of course those which were interpolated into the texts by people who are not entitled to do so during the period of decadence of the science. It is perhaps necessary in this connection to quote the views of Capt. G. Srinivasa Murti expressed in his memorable monograph on "The Science and Art of Indian Medicine" ( 1923 ). According to him "The Indian systems 'of' medicine ( italics mine ) are undoubtedly scientific; their general principles and theories ( both in subjects of preliminary scientific study like Physics, Physiology and the like, as also in the subjects of medical science proper, like Pathology, Medicine, and so on ) are quite rational and scientific." What is, therefore, now required is to provide the missing links in this field. Concepts and theories are required to be verified with a view to ascertain that they are not the unscientific interpolations made during the period of decadence, and then through scientifically planned experiments, data should be collected to improve upon these scientific concepts and theories. Simultaneously there should be an attempt to demonstrate their applied aspects in the field of diagnosis and treatment of diseases. The present work is an attempt on this line.

Dated 30-7-70.

**Bhagwan Dash**



## CONTENTS

	Page
1. PREFACE	iii
2. INTRODUCTION	vii
<b>SECTION I</b>	
3. AGNI AND THE SĀMKHYA SYSTEM	3
<b>SECTION II</b>	
4. AGNI IN NYĀYA—VAIŚEŚIKA	9
<b>SECTION III</b>	
5. CONCEPT OF AGNI IN ĀYURVEDA	23
6. AVASTHĀ PĀKA	55
7. JĀTHRĀGNI PĀKA ( VIPĀKA )	66
8. BHŪTĀGNI PĀKA	72
9. ANNAVAHA SROTĀMSI	77
10. DHĀTVAGNI PĀKA	81
11. METABOLIC EQUILIBRIUM	91
12. DIFFERENT STATES OF JĀTHRĀGNI	91
13. INFLUENCE OF DIFFERENT STATES OF JĀTHRA- RĀGNI UPON DHĀTUS	96
14. DHĀTUVAHA SROTĀMSI	97
15. ĀMADOṢA	109
16. ĀMA FORMATION DUE TO DHĀTVAGNI MĀNDYA	117
17. ŚARĪRBALĀ	120
<b>SECTION IV</b>	
18. AGNIBALA PARĪKṢĀ	122
19. ŚAKṚT OR STOOL IN RELATION TO AGNIBALA	129
20. AGNIBALAPARĪKṢĀ—PRACTICAL STUDY	143

21. PROCEDURE ADOPTED FOR THE EXAMINATION OF VYĀYĀMAŚAKTI AND ŪŚMOTPATTI	149
22. PROCEDURE ADOPTED FOR AGNIBALA PARĪKṢĀ	150
23. SIGNS AND SYMPTOMS RELATING TO THE STATES OF AGNI	154
24. DISCUSSION	171
25. CONCLUSION	175
26. APPENDIX	177
27. INDEX	193



### III. CONCLUSION

CONCLUDING STATEMENT OF THE INVESTIGATION

THE VARIOUS STATES OF AGNI AND THE AGNI TESTS

THE VARIOUS STATES OF AGNI AND THE AGNI TESTS

THE VARIOUS STATES OF AGNI AND THE AGNI TESTS

THE VARIOUS STATES OF AGNI AND THE AGNI TESTS

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### VI. CONCLUSION

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CONCEPT OF AGNI IN AYURVEDA.  
WITH SPECIAL REFERENCE TO  
AGNIBALA PARIKSĀ

АКАДЕМИЧЕСКИЕ МАТЕРИАЛЫ  
ОТ АКАДЕМИИ ДРУЖБЫ НАРОДОВ  
БОЛГАРСКОГО АКАДЕМИЧЕСКОГО

## SECTION I

### AGNI AND THE SĀMKHYA SYSTEM

*Agni*, in the *Sāmkhya* view, is potentially present in the *rajoguṇa*<sup>1</sup> of the *mūlaprakṛti*—the other two *guṇas* being, *sattva* and *tamas*. The *triguṇas*, in the *Sāmkhya* view, are considered to be the ultimate reals (*tattvas*). An enquiry into the ultimate factors of creation, according to this system, was based on :

( a ) *Satkāryavāda*—the doctrine of quantitative permanence and indestructibility of matter—corresponding to the law of conservation of energy ( mass ), which is basic to modern physical and chemical sciences ;

( b ) the doctrine of *parināma*—the theory of evolution—a logical corollary of *satkāryavāda* ;

( c ) the doctrine of ' *Kāraṇa* and *kārya*'—the law of causality;

( d ) the doctrine of ' *Kāla* and *dik*'—the theory of time and space ; among others, leading to the conclusion that the phenomenon of the universe one observes, is the outcome of the evolution of the primordial-matter-stuff or ' *mūlaprakṛti*' which is represented by three components of its pattern—spoken of as *triguṇas* viz., *sattva*<sup>2</sup> *rajas*<sup>3</sup> and *tamas*.<sup>4</sup> *Sattva*, *rajas* and *tamas* represent the essence or intelligence, the energy or motion and the inertia or mass respectively at the material and physical ( including biological ) planes and pleasure, pain and delusion respectively, at the psychological plane. According to the *Sāmkhya Kārikā*, the *guṇas* are of the nature

1. The *rājasika* component of *prakṛti* is also described as *taijasa*—meaning, related to *agni*.
2. *Sattva* is signified by whatever is pure, fine and illuminating ( Fundamental Principles of Ayurveda by Dr. C. Dwarakanath Part II, p. 36 ).
3. *Rajas* is signified by, whatever, is active and energetic ( Ibid. ).
4. *Tamas* is signified by whatever is passive and whatever offers resistance and restraint ( Ibid. ).

of pleasure, pain and delusion and, they are adopted to illuminate, activate and restrain. They mutually suppress, support, produce, concert and exist.<sup>1</sup>

The *guṇas* are stated to be in an equilibrated quiescent state, in the *sāmyāvasthā* of *mūlaprakṛti*. When possessed by *puruṣa*, a non-physical factor of consciousness and intelligence—the *sāmya* of the *mūlaprakṛti* is stated to be disturbed, and the *trigunas* collocate with one another, in an unequal distribution, within the *mūlaprakṛti* itself. They unite, separate and reunite. The things of the universe are evolved due to the peculiar property of *trigunas*, mentioned above viz., their capacity to combine, separate and recombine, in various modes of groupings. Even though, they react and interact with one another, they are, none-the-less, independent. The evolution of the definite from the indefinite and qualitatively determinate<sup>2</sup> from the indeterminate takes place, due to this peculiar feature of *trigunas* and the diversity of effects, observed at the phenomenal level, which characterise the things—physical, material, biological and mental are also due to this peculiarity.

It has been stated that “In the evolution of *mūlaprakṛti*, *sattva* and *tamas* by themselves, are incapable of performing any work. The various functions attributed to them are, in this view, due to *rajas* (energy) only, which on the one hand overcomes resistance and supplies energy on the other. Even so, *sattva*, also, needs the help of *rajas* (energy) to enable conscious adaption.”<sup>3</sup> Thus, it would seem that, the energy present in the multiplicity of diverse things in the phenomenal<sup>4</sup> universe is entirely due to *rajas*; resistance and

1. प्रीत्यप्रीतिविषादारमकाः प्रकाशप्रवृत्तिनियमार्थाः ।  
अन्योऽन्याभिमवाश्रयजननमिथुनकृत्यश्च गुणाः ॥ ( Kārikā xii ).
2. एते गुणे इतरेतराश्रयेण उपांतिसुखदुःखमोहप्रत्ययाः । Vyāsabhāṣya on Yogasūtra 2 : 15.
3. अन्योन्याभ्याम् अहंकाराभ्यां स्वकार्योपजनने राजसाहंकारः सहकारी भवति ।  
( Lokācārya; Tīvatrāya, Acit prakaraṇa ).
4. Phenomenon stands for the term *vyakta* and is the “form through which, it ( the thing ) becomes known to the senses or under-

stability to *tamas*; and every conscious manifestation to *sattva*.<sup>1</sup> In any phenomenon, therefore, the particular pattern i.e., *guna*, which happens to preponderate over the rest (the remaining two *gunas*), become manifest and others are sublatent. The presence of the latter is to be deduced from their observed effects. This aspect has been very ably summed up by Seal as : "In any material system at rest, mass is patent, energy is latent and conscious manifestation is sub-latent."<sup>2</sup> In the case of an active dynamic system, on the other hand, *rajas* (energy) is a dominant feature and the resistance to *tamas* (mass or inertia) is overcome. The transformation of *rajas* or energy is stated to proceed, hand in glove, with the preponderance of *sattva* and, in such cases, volitional consciousness accompanies the movement of *rajas* (energy) in phenomena, where, the former is predominant. In this instance, resistance to *tamas* (mass or inertia) is deduced to be overcome.<sup>3</sup>

Keeping the foregoing principles in view, it may not be difficult to follow the *Sāmkhya* theory of evolution of the macrocosm<sup>4</sup> and microcosm<sup>5</sup>—the evolutionary steps of moving in consecutive phases, until the state of *Tāmasika ahamkāra*, known also as *bhūtādi* from which *kāraṇākāśa* has been reacted. It is at this point, metaphysics merges into physics. *Kāraṇākāśa* corresponds to quiescent energy in the continuum, which constitutes the "sole physical constituent of

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standing." It is the opposite of noumenon which means "the unknown, and unknowable substance or thing in itself." (Fundamental Principles of Ayurveda by Dr. C. Dwarakanath : Part I. p. 5).

1. अन्योन्याङ्गभिमावेन उत्पादितेऽपि द्रव्ये प्रकाशगुणः सत्त्वस्थैव, क्रियागुणो रजसेव, स्थितिशुणस्तमसेव । (Yogavārtika on Vyāsabhaṭṭya on Yogasūtra 2:18)
2. B. N. Seal : "The Positive Sciences of the Ancient Hindus," p. 5.
3. प्रधानवेलायामुपदर्शितसंजिपाना गुणत्वेऽपि च व्यापारमात्रेण प्रधानान्तर्गतानुभितास्तिताः । ( Vyāsabhaṭṭya on Yogasūtra 2 : 18 ).
4. By macro-cosm is meant the physical universe or human society as opposed to micro-cosm, the human individual.
5. The term micro-cosm means small universe used figuratively of the human being; also sometimes of the world revolved by the microscope. ( A Dictionary of Psychology by James Drever ).

the universe," spoken of variously by modern-physics, as the "field-property," "electro-magnetic-field," "undulatory ether" and soforth. From out of *Kāraṇākāśa*, is stated to evolve the *kāryākāśa*, the former having been activated or disturbed by *rajas* or energy—an idea reminiscent of some of the current physical doctrines, viz., the existence of energy in the continuum in two states—quiescent and active, which passes from one state into another. The activation by *rajas* of the *kāraṇākāśa*, leading to the evolution of *kāryākāśa* has a parallel in the modern view, which accounts for the activation of the quiescent energy—Plank's constant 'h'—being suggested as the measure of least impact, that changes quiescent energy. *Vijnānabhikṣu* has already stated in *Yogavārtika* that *akāśa* has two aspects—the original and the derivative. The former, in his view, is a continuum (*Vibhu*) non-atomic and that it represents the all-pervasive vehicle or substrate of the ubiquitous energy i.e., *rajas* or *tejas*. The latter is atomic.

At this point, matter is stated not to admit of either addition or subtraction, neither can it be created nor destroyed. The evolution of *tanmātrās*, is stated to follow, soon after—*kāraṇākāśa*, represented by uncharged particles of *bhūtādi*, being charged by varying quanta of *rajas* or energy. Thus, *śabda*, *sparśa*, *rūpa*, *rasa* and *gandha* *tanmātrās*, represent varying quanta of mass and energy. These again collocate in various proportions and modes to form the five *mahābhūtas*.<sup>1</sup>

1. पद्मविशेषाः तथा शब्दतन्मात्रं स्पृश्यतन्मात्रं, रूपतन्मात्रं, रसतन्मात्रं, गन्धतन्मात्रं च इत्येकदित्रिचतुर्पञ्चलक्षणाः शब्दादवः पद्माविशेषाः … … ( *Vyasa-bhāṣya* on *Yogaśūtra* 2 : 19 ) अहंकारात् शब्दतन्मात्रं, ततथाहृक्तात् शब्दतन्मात्रात् शब्दस्पृश्यगुणं स्पृश्यतन्मात्रम् । एवं क्रमेण एकैकरुणवृद्धया तन्मात्राणि उत्पन्ने । ( *Pravacanabhāṣya* on *Sāṃkhyaśūtra* 1 : 62 ). तथा गन्धतन्मात्रं वर्जयित्वा चतुर्स्तन्मात्राणां स्नेहजातीयानां एकः परिणामः बलपरमाणुः, तेषां च महाजलादिः । एवं च गन्धरसौ वर्जयित्वा औष्ठ्यजातीयानां त्रितन्मात्राणां तेजो अणुः, तेभ्यो महातेजादिः, एवं गन्धरपरसाणां वर्जनात् द्राघ्यां वाय्वणुः, तेभ्यो महावाय्वादिः । एवं शब्दतन्मात्रात् अहंकाराशसहृक्तात् आकाशाणुः, तेभ्यो महाकाशादिः । … … अत्र दर्शने अयं सिद्धान्तः शब्दादितन्मात्रपञ्चके काठिन्यखेहादिव्यज्ञवा: पृथिवीत्वादिग्रातयः मन्ति…… ( *Yoga-vārtika* : on *Yogaśūtra* 4 : 14 ) अत्रायं क्रमः-भूतादेः शब्दतन्मात्रं जायते, शब्दतन्मात्रं भूतादिराष्ट्रोति, तत आकाशं जायते, ततः अस्मात्

It will be seen from the foregoing that, in dealing with *rajas* (energy) at different levels of the evolution of *prakṛti*, we are in fact, dealing with the problems of entropy.<sup>1</sup>

An important point to note here is the fact that, at the level of *rūpa tanmātra*, *rajas* is patent, *tamas* is latent and *sattva* is sublatent. The main property attributed to this *tanmātra* is radiation and heat—its other properties being vibration (*parispandana*) and motion (*vega*). Since *tanmātras* are also stated to evolve in a consecutive series of five steps, the first step

शब्दतन्मात्रात् स्पृश्यतन्मात्रां जायते स्पृश्यतन्मात्रां शब्दतन्मात्रमावृणोति, एवं  
शब्दतन्मात्रावृतात् आकाशसहायकात् स्पृश्यतन्मात्रात् वायुर्जायते, ततः अस्मात्  
स्पृश्यतन्मात्रात् रूपतन्मात्रां जायते, रूपतन्मात्रां स्पृश्यतन्मात्रमावृणोति, एवं स्पृश्य-  
तन्मात्रावृतात् वायुसहायकात् रूपतन्मात्रात् तेजो जायते and so on; अयं क्रमः  
तत्त्वत्रयविवरणे कृष्णपादैरुक्तः । वरवरमुनि तत्त्वत्रयभाष्य, ( अचित् प्रकरण ) ।  
( Extracted by Sir B. N. Seal, in his Positive Science of Ancient Hindus : pp. 26-36 ).

1. The concept of entropy can be briefly summed up as follows : Natural events tend to change from improbable (*avīśeṣa*) situations to more probable (*viśeṣa*) ones. The degree of improbability is ultimately determined by the amount of energy (*rajas*) required to maintain a given situation. Zero energy expenditure is equivalent to least improbability i.e., maximum probability or certainty. This concept can be illustrated as follows : The total environment, physical, chemical or biological, display a tendency towards balanced stability. For example when a glass of water is shaken, the fluid surface oscillates up and down; by oscillating, the system accommodates to the initial disturbance until the force of the latter is spent, and a stable condition is again attained. Events on earth can be compared to the seesawing of water. This initial disturbance was the cause of the formation of the solar system. Ever since environmental oscillation occurred--as they will occur in future also--tending to establish a stable balance, but such a balance cannot be attained as long as the sun shines and the earth spins; every imbalance creates a subsequent imbalance which tends to counteract the first. This, in essence, is the response principle, which moves the whole environment including the living system.

being represented by *śabda-tanmātra*, the second by *sparśa-tanmātra*, the third by *rūpa-tanmātra*, the fourth by *rasa-tanmātra* and the fifth by *gandha-tanmātra*; the relative status of *rajas* and *tamas* is gradually found to change, that, in the case of *rasa* and *gandha tanmātras*, *tamas* becomes patent, *rajas* latent and *sattva* sub-latent. In other words, upto the *rūpatanmātra* energy is manifest, and beyond this level, mass and inertia become more preponderant. However, *rajas* or energy is implicit in all *tanmātras*, as indeed in all the *sthūlabhūtas*, which latter represent *tanmātric systems*.

Thus, the phenomena of *tejas* or *agni*—understood at the phenomenal level, in many forms viz., the forces of motion, radiation, heat, electricity and magnetism (including forces of cohesion and friction) is implicit in the concept of and potential in *rajoguṇa* of *mūlaprakṛti*. The origin of *agni*—both the physical and biological is, therefore, to be traced to *rajoguṇa* of *mūlaprakṛti*. By implication, all the active and productive aspects of *parināma* or evolution, at the macro- and micro-cosmic levels are due to *rajas* (energy).

## SECTION II

### AGNI IN NYĀYA-VAIŚEŚIKA

According to *Nyāya-vaiśeśikas*, *tejas*, in which *agni* is implicit, is one of the *navadravyas*<sup>1</sup> and, it is represented by *tejasparamāṇu*. One of the properties ascribed to *tejas paramāṇu*, by *Nyāya-vaiśeśikas*, is heat.<sup>2</sup> Caraka has included *tejas* among the group of fundamental substances.<sup>3</sup> Both *Nyāya-vaiśeśikas* and Caraka have treated *tejas*, just like *pṛthvī*, *ap*, *vāyu* and *manas*, as *aṇu*.

The *Nyāya-vaiśeśika* school of natural science, representing the 'doctrine of commencement or *ārambhavāda* has postulated the view that, the order of creation must primarily be in the nature of creation, first, of the atoms or *aṇus* of *vāyu*, *tejas*, *ap*, *pṛthvī* and *manas* and, the things of the universe arise out of two or more atoms of these elemental substances being put together. This school of scientific thought has subscribed to the doctrine of a manifold of ultimate "reals or *tattvas*," whose atoms combine variously, to form the things of the universe.

The *ārambhavādins*, like the earlier physical chemists of modern times, described *aṇus* as follows: by dividing and subdividing things, a stage is reached, when, further division of matter is no longer possible. The matter, at this stage, is the *aṇu*.<sup>4</sup> According to *Kaṇāda* the union or combination of

1. तत्र द्रव्याणि पृथिव्यपृत्तेजोवाऽवाकाशकालदिग्यात्ममनांसि नवैव ।

( *Tarkasamgraha* ).

2. उष्णस्पर्शवत्तेजः । ( *Ibid* ).

3. स्वादीन्यात्मा मनः कालोदिशक्ष द्रव्यसंग्रहः । ( *Caraka* : *Sūtra* 1 : 48 ).

4. Robert Boyle ( 1627-1691 ) postulated the principle of the 'elements' or 'first principles,' of which matter was composed. He reviewed the atomic-hypothesis, held by Democritus and Lucretius—the Greek Philosophers—and defined the term 'element' as a substance, which may not be further analysed into simpler substances. However, the difference between the *Gautama* cum *Kaṇāda* school of thought and that of Boyle's relates

the elementary particles of *paramāṇus*, leads to the production of diverse forms of things. The *paramāṇus* combine, in twos (*dvyāṇukas*) and threes (*tryāṇukas*) and soforth,<sup>1</sup> to yield myriad of new things, arising out of the various modes of their combinations and permutations.

Udayana, in his *Lakṣaṇāvalī* has defined *tejas* as that which is the substratum of colour and which shares a common substratum with the absolute absence of taste.<sup>2</sup> *Kanāda-rahasya* has stated that "Tejas is that which has a common substratum with colour but not with weight. This represents the special feature of *tejas*.<sup>3</sup> According to *Vyomavati*, quoted by Umesha Mishra, the qualities of *tejas* can be summed up as follows—*rūpa* (Colour), *sparśa* (touch), *saṃkhyā* (number), *parimāṇa* (dimension), *pṛthaktva* (separateness), *sāmyoga* (conjunction), *vibhāga* (disjunction), *paratvāparatva* (priority and posteriority), *dravatva* (fluidity), *vega* (velocity)—colour and touch being the only distinct qualities of this element. Its colour is illuminating (*bhāsvara*) and, touch is hot (*ūṣma*).<sup>4</sup> According to *Praśastapāda*, the natural movement of *tejas* is upward.<sup>5</sup> Its colour and touch do not undergo any chemical change,

to the number of elements, which, in the former case, comprises of five kinds of atoms—*pṛthvī*, *ap*, *tejas*, *vāyu* and *manas*; whereas, according to latter as further modified by Dalton, envisaged over ninetytwo different elements. According to both the views, an element or *āṇu*, is a distinct species of matter, which has not yet been shown to be composed of two or more different kinds of matter (each atom is now, again, divisible into many parts viz. proton, electron and neutron etc.)

1. ततः परमाणुद्वयसंयोगे सति व्याणुकमुत्पत्ते । त्रिभिर्जिभिरेव व्याणुकैस्यव्याणुकम् । एवं चतुरणुकादि क्रमेण…… । (Dīpikā on Tarkasamgraha).
2. *Lakṣaṇāvalī* by Udayana : Reprint from the "Pandita," Benaras : p. 31. Quoted by Umesha Mishra in his "Conception of Matter" 1936 Edn. p. 329.
3. *Kanādarahasya* by Śāṅkara Miśra : Chawkhamba, Benaras Edition : pages 17, 18, quoted by Umesha Mishra in his conception of Matter, 1936 Edn. p. 329.
4. Conception of Matter by Umesha Mishra, 1936 Edn. p. 329.
5. *Padārthadharma Saṃgraha* by Praśastapādācārya : Vizianagaram Sanskrit Series Edn. p. 39.

hence, they are *nitya* or eternal in the *paramāṇus* and *anitya* or non-eternal in *kārya* or products.<sup>1</sup>

According to Udayana, the solar-heat is the source of all the store of heat required for chemical change in the world. Citing the example of the colour of grass, he has stated that it (the colour) is due to *tejas* in the form of invisible heat, not in the form of *agni* and, that the cold, in winter, cannot take away the store of heat, derived from the sun.<sup>2</sup>

Annaṁbhaṭṭa in his *Nyāyabodhī* on *Tarkasāṅgraha*, has stated, "An unripened fruit ripens, under the influence of solar-heat. Ripening of an unripened mango results in the change of colour, taste and smell etc." This is referable, in his opinion, to the subtle decomposition and recombination (*samyoga* and *vibhāga*) that goes on in it. Likewise, is the cause of the rusting of metals in combustion, due to *suryapāka* or solar heat. The conversion of food into *rasa*, and *rasa* into *rakta* are again examples of action due to *jāṭharānala* or *audaryatejas*. The nature of contact with *tejas paramāṇu* or the kind of *pāka* (chemical action which brings about a change, in respect of colour), in his view is different from that which transforms flavour—*yilakṣaṇa-tejah-samyoga* and *pāka*. This applies equally to change in tactile quality.<sup>3</sup> The same authority has stated that, the substance *tejas* possesses the

1. नित्यं परमाणुरूपम् अनित्यं कार्यरूपम् । ( *Tarkasāṅgraha* ).
2. तुणादिविकारो हि यदि रूपादिपरावृत्तिमात्रहेतुः स नूनमौष्ण्यापेक्षेण तेजसा कर्तव्यः । तादृशे च पाके अनिमित्तं हिमभिति । न किंचिदनिष्टमापद्यते । न हि सौरस्य तेजसः त्रैलोक्यपाकहेतोः हिमादपगमः क्षमते । अथ विकारो भस्मादिरूपे विवक्षितः । सोऽसिद्ध एव हिमहितेषु तुणादिपु तुणादिपु क्व विरोधो वादा वा । अथ रूपादिपरावृत्तिमात्रैव अधिः साध्यते तदशक्यम् । तस्य दर्शनस्पर्शनग्राह्यस्य योग्यानुपलभ्यमवाधितत्वात्, अतादृशस्य तेजोमात्रस्य निष्टोरशक्यत्वादनिष्टस्थाच । ( *Udayana* : *Kirāṇavalli* सुचित्संहारविधिनिरूपणम् )
3. पाको नाम विजातीयतेजःसंयोगः । स च नानाजातीयः । रूपजनकविजातीय-तेजःसंयोगस्तदपेक्षया रसजनको विजातीयः । एवं स्पर्शादी अपि तथा । एवं प्रकारेण भिन्नाभिन्नजातीयाः पाकाः कार्यैवलक्षणपेक्षेण कल्पनीयाः । तथा हि तुणपुञ्जनिक्षिपात्रादौ उण्णलक्षण-विजातीयतेजःसंयोगात् पूर्वैहरितरूपनाश-रूपान्तरस्य पीतादैरुत्पत्तिः, पूर्वरसस्य अम्लरसैवानुभवाद् । क्वचित्पूर्वैहरितरूप-सत्त्वेऽपि रसपरावृत्तिरूपत्वते । विजातीयतेजःसंयोगरूपपाकवशात् पूर्वतनाम्ल-

property of heat and could be cognised by tactile perception. It may occur in two forms—( a ) *nitya* or eternal ( indestructible ), ( b ) *anitya* or transient. The former is in the nature of *paramāṇu* ( atomic or corpuscular ); on the other hand, the latter is to be understood as *kārya* or effect.<sup>1</sup> *Anitya* or the transient type occurs in three forms viz., ( i ) *tejas-śarira* or the physical form of *tejas* which is well-known in *suryaloka* ( solar system ); ( ii ) *indriya-tejas* is the sensory form of *tejas*. It is to be seen, at a point, within the black of the eye ( pupil ). It makes visual perception possible<sup>2</sup> and, ( iii ) *viṣaya-tejas* or the *tejas* which occurs in the objects of the senses. This variety is of four kinds :

( 1 ) *bhauma tejas* or *agni* of the earth, such as fire etc.<sup>3</sup>  
 ( 2 ) *divya tejas* or the *tejas* of the sky such as lightening, rays of the sun, moon and stars.<sup>4</sup> ( 3 ) *audarya tejas*

रसनाशे मधुररसस्यानुभवात् । तस्माद्रूपजनकपेक्ष्यवा रसजनको विलक्षण  
 एवाङ्गीकार्यः । रूपरसयोरपरावृत्तौ अपि पूर्वगन्धनाशे विजातीयपाकवशात् सुर-  
 भिगन्धोपलब्धेः । एवं स्पृश्यजनकोऽपि पाकवशात् कठिनस्पर्शनाशे मुदुस्पर्शानुभवात् ।  
 अतएव पार्थिवपरमाणूनामेकजातीयत्वेऽपि पाकमहिमा विजातीयद्रव्यान्तरानु-  
 भवः । यथा गोमुक्तुण्यादीनां आपरमाणवतं मङ्गे तृणारम्भकपरमाणुषु  
 विजातीयतेजःसंयोगवशात् पूर्वरूपादिचतुष्टयनाशे तदनन्तरं दुर्घे यादृशं  
 रूपादिकं वृत्तैते तादृशरूपरसगन्धनकास्तेजःसंयोगाः जायन्ते । तदुत्तरं तादृश-  
 रूपादयः उत्पन्नन्ते । तादृशरूपादिविशिष्टपरमाणुभिः दुर्घणाणुकमारम्बदेते ।  
 ततः ऋणुकादिकमेण महातुम्बारम्भ इति ॥ ( Nyayabodhini on Annam-  
 bhatta's Tarkasamgraha ).

1. Light, according to modern view, has got two forms viz., particle or corpuscular and wave. Whenever it hits, whenever it enters our eyes, burns our skin or takes a photograph, then light is said to behave as particles. It is, in the act of getting to us and in particular, the quantity of it that gets to us is stated to behave as waves. Apparently, therefore, the particle or corpuscle represents the *nitya* type of *tejas*. Its wave form occurs as *kārya* or the effect, when it performs *karma* or motion i.e., when it is active. It is in this aspect of *tejas*, that the *anitya* or transient form may have to be understood.
2. This form of *tejas* has been described as *aloeaka pitta* in *ayurveda*, corresponding to the visual purple of retina described by modern physiology.
3. *Bhauma tejas* : Oxygen, which is responsible for oxidation, is a form of *bhauma tejas*; so also is the case with phosphorescence of the glow-worm.
4. Eelectro-magnetic phenomenon and the stellar emanations.

or the *tejas* that occurs in the gastro-intestinal secretions, which, latter, are held to be responsible for the execution of the digestion of food and drink<sup>1</sup> and (4) *ākaraja tejas* or the *tejas* present in metals (minerals?) dug from mines, such as gold, silver etc.<sup>2</sup>

Implicit in the foregoing citation is the idea, that heat and light represent the obverse and reverse of the same coin viz., *tejas*.

According to Udayana, heat and light rays are stated to consist of extremely small particles, which dart-forth or radiate rectilineally in all directions, at an inconceivable speed.<sup>3</sup> The way in which *tejas* in its two aspects viz., heat and light works, has been described by the same authority. According to him heat may either penetrate through the inter-molecular-spaces, as in the case of conduction of heat, which when applied under the pot, boils the water or fries the paddy, without involving the pot in any chemical reaction i.e., causing no decomposition or recombination of its molecules; no change of its molecular collocations, is stated to take place. As regards the phenomenon of translucency or transparency (*svacchatā*), light rays, in his view, penetrate through the inter-atomic-spaces, with vibration (*parispanda*) of the nature of deflection or reflection (*tiryaggamana*), very much as when fluids penetrate through porous bodies (तत्र परिस्पन्दः तीर्यग्मामनं,

2. This corresponds to *pāeka pitta* or *jāṭharāgni*, *dhātvegni* and *bhuṭagni* of *Āyurveda*, which in its turn parallels the enzymes of the gastro-intestinal tract and the other metabolic agents.
3. Ions, radio-active metals and minerals. उण्णस्पर्शवत्तेजः । तद्दिविषम् । नित्यमनित्यं चेति । नित्यं परमाणुरूपम्, अनित्यं कार्यरूपम् । पुनस्त्रिविषं शरीरेन्द्रियविषयमेदात् । शरीरमादित्यलोके, इन्द्रियं रूपग्राहकं चक्षुः, तच्च कृष्णतारायवर्ति । विषयः चतुर्विषः—मौमदिव्यौदर्याकरजमेदात् । मौमं वहयादि, दिव्यमविन्वनं विषुतादि, भुक्तस्य परिणामहेतुरौदर्यम्, आकरजं सुवर्णादि । ( *Tarkasamgraha—Tejonirupana* ).
4. अचिन्तयो हि तेजसो लाघवातिशयेन वेगातिशयः यत् प्राचीनाचलचूडावलम्बनि एव भगवति मयूखमालिनि भवनोदरेषु आलोक इत्यभिमानं लौकिकानाम् ।

( Udayana : *Kirāṇīvali—Tejonirupanam* ).

परिक्षेपः पात् इति )<sup>1</sup> or in the alternative, they may impinge on *paramāṇus* and rebound back ( मूर्च्छनं किरणविघटनं ).<sup>2</sup> They may, also, be obstructed by *anus* in their pathway, leading to degrees of shadows or opacity. All these phenomena are, also stated to be physical and not due to decomposition ( *vibhāga* ) and recombination ( *samyoga* ) or the alteration in the molecular grouping.

Light, in this view, may also hit the *paramāṇus*, in a peculiar way, so as to break up their grouping, transform the physico-chemical characters of the *anus* and, again, recombine them due to its chemical impact, at an inconceivable velocity.<sup>3</sup> & <sup>4</sup>

1. Udyotakara on *Vatsyāyanabhāgya* on *Nyāyaśūtra* 3 : 1 : 47.
2. B. N. Seal : The Positive Sciences of the Ancient Hindus, p. 116.
3. वर्तिदेशे पिण्डितमपि तेजः प्रसरंत प्रासादोदरं व्याप्त्वोति । तत् कस्य हेतोः ? पृथग्ग्रन्थात् । स्वभावतः प्रसरदपि न स्वपरिमाणानुविधायिनं प्रत्ययमात्तत्त्वे, किं तु विषयमेदानुविधायिनं । स्फटिकान्तरितोपलभित्तिरपि प्रसादस्वभावतया स्फटिकादीनां तेजोगतेरप्रतिवन्धकतया प्रदीपप्रभावादेवोपपत्ता । Udayana तेजोनिरूपणम् in reply to the objection यदि हि प्राप्य गृहीयात् प्रतिवातिना स्फटिकद्वयेण विष्टम्भादप्राप्तं प्रसर्त्तृणादिकं नाददीत, तस्माद् प्राप्यकारि, ततो न तैजसम् Udayana : Ibid : Definition of *Svacchata*, द्रव्यान्तरासमृक्तद्रव्यसमवयः स्वच्छता । दृष्टश्चाप्रतिवातः काचाभ्रपतलस्फटिकान्तरितोपलभ्यः । स्थाल्यादिषु च पाचकस्य तेजसाऽप्रतिवातात् । Udyotakara 3 : 1 : 38. आदित्यरहमेः स्फटिकान्तरितेष्वि दाहोऽभिवातात् स्वय द्रव्यस्यावयवा न व्युहान्ते तस्य अन्तरावयवैः अव्युहमानस्य योऽभिसम्बन्धः सोऽभिवात् इति । Vacaspati explains यस्य द्रव्यस्य भर्जनकपालादेः अवयवाः पूर्वोत्पन्नद्रव्यारम्भकसंयोगनाशेन द्रव्यान्तरजनकसंयोगोत्पादनं व्युहानं तत्र कियते यस्य द्रव्यस्य भर्जनकपालादेरव्युहमानस्य अन्तरावयवैः योऽभिसम्बन्धः वह्नेः सोऽप्रतिवातः । अन्तः प्रवेशः कृशानोरनुमीयते । तेन वेगवता वह्निद्रव्येण नोदनादभिवातादा अवयवेषु किया, कियातो विभागः । विभागादारम्भकसंयोगविनाशः etc. Jayanta Bhatta in *Nyāya Mañjari*, भृत्यैतन्य, पूर्वपक्षः । For opacity, shadows, etc. vide छाया तु तेजःपरमाणोरावरणात् मूर्तिमता अस्य परमाणुना तेजःपरमाणुरात्रीयते । यत्र च आवरणं तत्र छायेति । विरल तेजःसम्बन्धीनि द्रव्यगुणकर्मणि छाया इत्यभिर्यते । सर्वतो व्यावृत्तेजःसम्बन्धानि तु तानि तमःसंहकानि ( Udyotakara, 4 : 2 : 25 ).
4. This description has a parallel in the Chemical action brought about by ultraviolet and X, rays.

The foregoing are among the few important references to *tejas* (*agni*) in the *Nyāya-vaiśeṣika* system of natural philosophy. There are many more such references but the few cited here would suffice to invite attention to the fact that, these two ancient schools of scientific thought have offered a fully developed theory, relating to light and heat. What is perhaps important in the context of this thesis is the application of these theories in practice, to explain a variety of phenomena which border on thermo-dynamics.

The theories of *Nyāya* and *Vaiśeṣika* relating to *pāka* (chemical action) are based on their concept of *tejas*, *kāla* and *dik*. These theories are germane to this paper.

*Nyāya-vaiśeṣika concept of pāka (chemical-action) :—* *Pāka-kriyā*, as described by *Nyāya-vaiśeṣika* system may sound to be quaint when studied on the background of modern concept of chemical action. None-the-less, they appear to be basically sound, in principle, even when examined from modern points of view. In the view of this system, when an object is brought in contact with *tejas*, motion or *karma* is stated to be produced in the ultimate constituents (*anus*) of that object, due to *abhighāta*<sup>1</sup> (forcible contact) or *nodana*<sup>2</sup> (impulsion) of *tejas*. (The *Nyāya-vaiśeṣikas* reject force operation i.e., *śakti* except as modes of motion—*karma*). This motion, in its turn, is held to produce *vibhāga* (disjunction), which results in this destruction of the *samyoga* (con-

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1. *Abhighāta*, in this context refers to motion, due to direct contact, for an instant, with a body that shrinks and produces an impact, e.g. the case of a stonefall against a hard object the potter's rod striking the wheel and the mortar struck against the pestle. Instantaneous disjunction is necessary to impact.
2. The motion of an object pushed or pulled by hand; the motion of the mud under heavy stones; the motion of an arrow due to the pressure exercised by the bow-string due to elastic law as it reverts to its original shape; the motion of clouds and volumes of dust; of air borne vehicles, sailing vessels and vehicles under an impelling force-pressure of the wind etc.

juction) that existed between the various constituents of the substrate resulting, finally, in their breakdown into their ultimate particles (*paramāṇus*). When thus, loosened their attachments, *paramāṇus*, in contact with another group of *tejas*, results in the destruction of their original *guṇas* or qualities. Subsequently, again, similar fresh contact with *tejas* is stated to take place, which results in the production of fresh *guṇas* in the place of old ones. These latter *guṇas* are known as *pākaja* (due to the influence of chemical action).

It would, in other words, appear that a single contact with *tejas*, which destroys the previous *guṇas* or qualities of the substrate, may not produce fresh *guṇas* or qualities in the place of old ones. By implication, the destruction of the old *guṇas* and the emergence of new ones, depend upon several contacts, at distinctive periods of time, between the substrate and *tejas*. This interesting description of *pāka* or chemical action, has been described under two headings, viz., *pilu* and *pīṭhara pākas*.

### *Pilupākas*

The term *pilu* refers to *paramāṇu* (atom) and the term *pāka* to the transformation or change brought about in the relationship between *pilus*, under the influence of *tejas* (light and heat). According to *Vaiśeṣikas Pilus*, (*paramāṇus*) combine, separate and recombine, under the influence of *tejas*—heat and light.<sup>1</sup> In this view, the difference observed between one substance and another or generally speaking, between all substances, as regards their colour, consistency (roughness and smoothness etc.) is due to *pākabheda*s (difference in chemical actions). According to *Vācaspati Miśra*, it is *agni* and *agni* alone that can cause transformation in respect of colour, tastes, smell or physical characteristic of *paramāṇus*. This depends, in his view, on (a) the nature of the constituent substance in contact, (b) intensity or degree of *agni*, described in terms of *khara*, *mṛdu* and *madhya*, and the species of *tejas*

1. Endothermic and exothermic reactions.

*anu* that impinge on *anu*s or atoms and the nature of the impact (*vilakṣaṇa-tejas-samīyoga*).<sup>1</sup>

Stated in brief, the *Vaiśeśika* school holds that “decomposition of *piṭharas* into *pīlūs*, which compose them; the transformation of the qualities of *paramāṇus*, and finally their recombination, all take place under the influence of *tejas*.<sup>2</sup>

Various are the examples given to illustrate the *pākas* substances undergo under the influence of *agni*. The ripening of an unripe mango under the influence of solar heat resulting in the transformation or change in the colour, taste, smell etc., of the latter is one such example.

These changes are considered to be brought about by subtle (*sūkṣma*) chemical action resulting in the decomposition and recombination of molecules (*piṭharas*) under the influence of heat supplied from outside (*vijātiya*<sup>3</sup> or *vilakṣaṇa-tejah-samīyoga*). Implicit in this example, is the idea of the presence in the molecules of the mango of *sajātiya tejas* which when activated by *vijātiya tejas* leads to radical changes in the physical and chemical characteristics of the fruit. This example has special reference to *pākas* to which organic substances are subjected and it has relevance to the study of *pākādi karma* to which *āhāra dravyas* are also subjected, likewise, in the living body.<sup>4</sup>

1. न ब्रूमोऽग्निसंयोगात् एकत्मात् रूपादय शति, अपि तु पूर्वरूपादिविशेषापेक्षात्। यद् द्रव्यं पच्यते अग्निसंयोगेन तस्य ये पूर्वरूपादयस्तेषां वः स्वगतो विशेषस्तमपेक्षमाणः अग्निसंयोगः उत्तरान् रूपादीन् विशिष्टानारम्भे। Quoted by B. N. Seal in the Positive Sciences of Ancient Hindus, p. 105.
2. अस्माकमेदे अपि उपादानस्य पिठरस्य औषध्यापराख्यस्य च वहिः संयोगस्य पूर्वरूपादिप्रब्लंसानां कारणानां भेदात् भिन्नजातीयाः जायन्ते गन्धरूपरसस्यशाः इति सिद्धान्तः। (Ibid.).
3. The *Vijātiya-tejah-samīyoga* referred to here is reminiscent of the optimum temperature required for enzyme action and oxygen. The obvious fact is that, the heat mentioned is atmospheric in nature. This represents energy, the origin of which is the Sun.
4. Umeśa Miśra has quoted *Vyomīvattī*, a commentary on *Padārtha-dharmasaṅgraha*, also known as *Praśastapāda bhāṣya* (Vizianagaram Sanskrit Edition), as stating that these *pākas* include-

The example of *pākas* which take place during the baking of a clay pot in a kiln usually cited by *Nyāyavaiśeśikas* are of interest and will be instructive. In the process of the baking of a raw clay-pot by a potter under the condition of temperature that obtains in the potter's kiln, quick succession of changes are considered to take place in the material of the pot in respect of its colour, density and consistency etc., similar to changes that take place during the process of cooking of food. The *vaiśeśikas* interpret and explain the successive phases of transformation and changes, as due to the decomposition of the constituent molecules of the material pot into their component *anuṣ* (atoms) and the subsequent recombination of the latter under altered spatial relationship—different from their original configuration—in the material of the raw-clay-pot which was subjected to the action of *agni*. The entire process of change in the molecular and atomic configuration is stated to occur in these consecutive steps viz.,

- ( i ) the decomposition of the material of the pot into its molecules, in the first stage;
- ( ii ) the decomposition of the molecules into their constituent *anuṣ*, in the second stage;
- ( iii ) the recombination of the *anuṣ*, in new relationship and altered spatial alignment, into molecules of two *anuṣ* (*dvyanukas*), three *anuṣ* (*tryanukas*) and soforth.

Thus, the spatial relationship that originally existed between one *anu* and another, in the material of the unbaked clay-pot is now seen to be completely changed resulting in the

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even human body, but generally, "no example is taken from these cases, for the simple reason that if anyone comes to know of the chemical action, taking place in him, he may be disgusted with his own body and his interest may cease towards it."

( Author's comment : This peculiar attitude was perhaps the *cause-belle* for the neglect and avoidance of any mention of the details of *pākadi karmas*, referred to in the latter Āyurvedic commentaries such as those by Cakrapāṇi Datta, Dalhana, Aruṇa Datta, Hemādri and soforth ).

exhibition, by the finished pot of new properties as regards its colour, density, consistency etc.

The transformation or changes referred to, in the foregoing paragraphs, are stated to occur in nine *kṣaṇas*—each *kṣaṇa* being equal to 2/45th of a second.<sup>1</sup> The quaint way in which *Vaiśeṣikas* have described these nine steps, corresponding to nine *kṣaṇas*, mentioned above, are as follows—"It takes nine *kṣaṇas* or moments for the completion of the consumption of the change from the unbaked to baked state of the clay-pot. In the first moment (*kṣaṇa*) the *dyuṇukas* are destroyed. In the second *kṣaṇa*, the original black colour of the unbaked clay-pot is destroyed. In the third *kṣaṇa*, a different colour—red—is generated under the influence of heat and light. In the fourth *kṣaṇa*, the *paramāṇus* combine to form the new substance. In the fifth *kṣaṇa*, the *paramāṇus* separate themselves from their old position i.e. from their former place. In the sixth *kṣaṇa*, they separate themselves again. In the seventh *kṣaṇa* they combine with other *paramāṇus*. In the eighth *kṣaṇa*, they again align themselves as molecules of two *paramāṇus* i.e. *dvayaṇukas*. In the ninth *kṣaṇa*, the specific or characteristic properties of the *paramāṇus* such as colour, touch etc., manifest in the constituent *dyuṇukas* of the material of the new (now) fully baked pot.<sup>2</sup> Thus, in nine moments or *kṣaṇas*, the soft, dark, unbaked clay pot is transformed into the hard and red baked pot. The concept of *pīlu-pāka*<sup>3</sup> may be aptly described as chemical change.

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1. A *kṣaṇa* of *Nyāya-vaiśeṣika* is equal to 2/45th of a second. (Fundamental principles of Āyurveda by Dr. C. Dwarakanath : Part I, p. 40).
2. *Kaṇḍdarahasya* by Śaṅkara Miśra : Chawkhamba Benaras Edition : p. 61.
3. अत्र परमाणुवेव पाकः न ब्रुणकादौ । आमपाकनिश्चिते व्ये परमाणुपु रूपान्तरो-  
त्पत्तौ श्यामवटनाये पुनः ब्रुणकादिकमेण रक्तघटोत्पत्तिः । तत्र परमाणवः  
समवायिकारणम्, तेजःसंयोगोऽस्मवायिकारणम्, अदृष्टादिकं निमित्तकारणम् ।  
ब्रुणकादिरूपे कारणरूपसमवायिकारणमिति पीलुपाकवादिनो वैशेषिकाः ।  
(*Dīpikā on Tarkasamgraha*).

*Piṭhara pāka*—

*Piṭhara pāka* means “the union of cause and effect (*kārana* and *kārya*) i.e. atoms by means of heat.<sup>1</sup> The *Naiyāyikas* hold that the *piṭharas* or molecules or larger aggregates of them, assume new characteristics, under the influence of heat, without involving the break down of the molecules or change in the characteristic of the *paramāṇus*.<sup>2</sup> That is to say, *piṭharas* (the material of the clay pot is stated to be composed of numerous *piṭharas*), undergo transformation under thermal influence. Consequential changes in them relate merely to a physical change of the molecules concerned. In this view, the *pāka* does not imply any radical change of the *āṇus* which compose the *piṭharas*. A *piṭhara* is stated to consist of two or more *āṇus* (atoms). The change in colour from black to red, assert the *Naiyāyikas* is really a change in the colour of *piṭharas*. This view resembles modern description of physical change.

Thus, according to *Nyāya-vaiśeṣikas*, all changes at the macroscopic and microscopic, and organic and inorganic levels, are due to *pākas*, i.e. chemical actions, brought about under the influence of *tejas* (*agni*). *Agni* in this view, is the power which is responsible for bringing about the break down and synthesis of substances. The action of *agni* is correlated to and is implicit in the motion or *karma*<sup>3</sup> performed

1. Sanskrit-English Dictionary : Monier Williams page 625.
2. पूर्ववर्णनाशं विनैव अवयिविनि अवयवेषु परमाणुपर्यन्तेषु  
च युगपद्मान्तरोत्पत्तिरिति पिठरपाकवादिनो नैयायिकाः ॥  
( *Dīpikā* on *Tarkasamgraha* ).
3. The *karma* or motion, described by this system under the influence of *tejas*—is reminiscent in some respects of modern views on thermal disorder, according to which, “the irregular motion of molecules of any material substance is known as heat or thermal motion, for the simple reason that these motions are responsible for the production of heat. Such molecular motions, visible in the slanting beams of the sun falling into a dark room through a chink or hole, or the molecules which make up water or any other substance is known as Brownian motion. These molecules oscillate back and from, colloiding with one

by bodies as will be evident from the observations of Caraka regarding *karma* viz., "action which is the cause of *samiyoga* (conjunction) and *vibhāga* (disjunction) is implicit in the substance or *dravya*. Action is the performance of what is to be done. It depends on nothing else."<sup>1</sup>

*Summing up* : The concept of *tejas* (*agni*), is implicit in the *rajas* of *Sāṃkhya system*, *Rajas*, according to this system of scientific thought, stands for kinetic energy of the universe. All events—at the galactic, molar, molecular and atomic levels (including the physiological and psychological)—are governed by the important and vital role played by *rajas*. The doctrine of *rajas* of *Sāṃkhya system* represents one of the fundamental aspects of a pure science.

The *Nyāya-vaiśeśika* system of scientific thought, which deals with *tejas* (*agni*), *karma* (motion) and *pākas* (chemical

another at random. Greater the agitation, the higher is the temperature. When a liquid freezes, molecular motion is reduced sharply. At a temperature of  $-273^0$  C or  $-459^0$  F, thermal agitation of matter completely ceases and all its molecules come to rest. This is apparently the lowest temperature—known as absolute zero. Still lower temperatures do not seem to exist because, there is no motion lower than the apparent rest. Near the point of absolute zero temperature, molecules of any substance have little energy, and the cohesive forces which act upon them cement them together into a solid block. In this state, the molecules can only quiver slightly in their frozen state. When the temperature is raised, the quivering becomes more intense and at certain stage, molecules obtain freedom for motion and they slide by one another, and the rigid frozen substance becomes fluid. The temperature at which melting occurs, depends upon the strength of the cohesive forces which act upon the molecules. More thermal agitation breaks up the cohesion and the molecules become loosened completely and move up e.g. the evaporation of water. Thus, for every motion, *agni* is essential and this motion, in its turn produces *agni*.

1. संयोगे च विभागे च कारणं द्रव्यमाभितम् ।

कर्तुं द्रव्यस्य किया कर्म कर्म नान्यदपेक्षते ॥ *Caraka : Sutra 1 : 52.*

actions) on the other hand would appear to represent an applied aspect of science.

From the *Upaniṣadic* point of view, *agni* and *soma*, known also, as *anna* and *prāṇa* respectively, represent two aspects of the universe.<sup>1</sup> The term *soma* or *anna* has been interpreted as referring to the things of the universe, which are utilised for existence.<sup>2</sup> It has been stated that *soma* or *anna* represents the matter-stuff of the universe, which allows itself to be cooked (decomposed or disintegrated). That which cooks *soma* or *anna* is stated to be *agni*—also known as *prāṇa*. *Soma* and *agni* are stated to be inseparable, that is to say, they are bound together inseparably—‘मिथुनसृष्टाद्यते’ (mithuna-sṛṣṭādya-tate). This inseparable relationship of the two has been described as ‘*rayi*’ (रयि).

In modern scientific thought, matter and energy correspond to *soma* and *agni*. Energy and matter, according to modern views, are not separable from one another; they are interchangeable. All things of the universe represent two aspects of nature i.e. matter and energy, which are in a state of *mithuna*. In other words, they represent the obverse and reverse of the same coin. It may be added that the view summarized above as regards *agni* and *soma* are also shared by Suśruta.<sup>3</sup> The only point which need an emphasis, here, is the fact that, *agni* is the kinetic factor at all levels of nature.

1. (a) अग्नीषोमात्मकं जगत् । *Śatopatha Brāhmaṇa* : *Kāṇda* 6 :

*Brāhmaṇa* 1.

(b) अग्नीषोमीयत्वाज्जगतः । *Suśruta* : *Sūtra* 40 : 5.

2. अथते अस्ति च भूतानि तस्मादनन्तं तदुच्यते । *Taittirīya Upaniṣad* : 2. 2. 1.

3. The reference to views held by Suśruta on this issue has been mentioned by Vāgbhaṭa both in his *Samgraha* and *Hṛdaya*.

Suśruta's reference runs as follows :

(a) अग्नीषोमीयत्वाज्जगतः: *Suśruta* : *Sūtra* 40 : 5.

(b) नानात्मकमपि द्रव्यमन्नीषोमौ महाबलौ ।

व्यक्ताव्यक्तं जगदिव नातिकामति जातुचित् ॥

*Aṣṭāṅgasamgraha* : *Sūtra* : 17 and *Aṣṭāṅgahṛdaya* : *Sūtra* 9 : 17.

## SECTION III

### CONCEPT OF AGNI IN ĀYURVEDA

*Agni* in *Āyurveda*, is reflected in the concept of *pitta* of this system.<sup>1</sup> The term *pitta* is derived from the root 'tap'— to heat or 'to burn'.<sup>2</sup> This term is seen to have three meanings viz., तप ऐश्वर्ये, तप दाहे and तप सन्तापे.<sup>3</sup> (a) *tap saṁtāpe* refers to the generation of heat;<sup>4</sup> (b) *tap dāhe* relates to the act of burning of the nutrition consumed<sup>5</sup> and (c) *tap aisyarye* refers to that factor which is responsible to make one achieve the eight kinds of benefits.<sup>6</sup> These references are obtained from the Bhattoji's *Siddhāntakaumudi* and would therefore furnish the *vyākaraṇa* version of the term *pitta*. From the point of view of *Āyurveda*, *pitta* has been described as *agni* (fire), since it performs fire-like actions i.e. *pāka*, which refers to *pācana* (digestion); *dahana* (burning, combustion or oxidation) including *bhinna samghāta* (splitting); *tapana* (heat production), *parinamana*<sup>7</sup> (conversion), *parāvṛtti*<sup>8</sup> (transformation), *prakāśana* (illumination), *rañjana* or *varṇakara* (colouration) and *prabhākara* (to cause lustre).<sup>9</sup>

1. अग्निरेव शर्णारे पित्तान्तर्गतः……। *Caraka* : *Sutra* 12 : 11.

2. तप संतापे……। *Suśruta* : *Sutra* 21 : 5.

3. तप ऐश्वर्ये—*dvividhi ganya*—( तप्यते )

तप दाहे—*dvividhi ganya*—( तापयति, तपयति )

तप संतापे—*bhividhi ganya*—( तपति ) *Siddhāntakaumudi*.

4. तपति क्षमाणमुत्पादयतीति पित्तम्।

5. तापयति दहति मुक्तमाहारजातं इति पित्तम्।

6. तप्यते विष्वर्माणमादिकमिति पित्तम्।

7. पाकः परिणतौ ( *Medini* ).

8. पाकः परावृत्तिः ( *Ibid* ).

9. Some of the functions ascribed to *pitta* such as *pācana* including *bhinna samghāta* (splitting), *dahana* (burning, combustion, oxidation), *tapana* (heat production), *parinamana* (conversion) and *parāvṛtti* etc. are reminiscent of some of the chemical reactions described by modern chemistry and biochemistry. They

In a general sense, the term *kāya* or body itself has been equated to *agni*.<sup>1</sup> Caraka has recorded Marici as having stated that "it is only *agni*, which is located in *pitta*, that gives rise to beneficial or adverse consequences according as it is in normal or abnormal state of functioning."<sup>2</sup> Clarifying the implication of the term *pittāntargata*, used in above description, Cakrapāṇi has observed that, this term does not mean that the *pitta* of the body is flaming fire and it only refers to the phenomenon of heat which is associated with fire.<sup>3</sup> By implication, heat is seen to be associated with the function of *pitta*. The references made by *Medini* and *Amarakoṣa* to the functions of *pitta*, have a direct bearing on the *pāka karmas* to which *āhāradravyas* are subjected, resulting in their *parināma* or transformation. The implications of these two aspects of *pitta-vyāpāra*, are the digestion of food and its transformation into various functional and structural factors of the body.

The question if *pitta* and *agni* are identical or different has been raised and answered by Suśruta in the 21st chapter of the *sūtrasthāna* of his *Śāhīta*. The passage under reference runs as follows—"It may now be asked, if *pitta* is the same as *agni* or it is something different. This question may be answered by stating that *pitta* is the same as *agni*, since it performs *dahana*<sup>4</sup> (burning, combustion or oxidation) *pacana* (digestion) and similar actions performed by fire, hence *pitta*

are combination reaction, substitution reaction, addition reaction, decomposition reaction, dissociation reaction, displacement reaction, hydrolysis reaction, oxidative reaction and reduction reaction. These reactions are usually mediated by catalysts. In bio-chemical reactions, organic catalysts, viz., enzymes accelerate these reactions.

1. जाठरः प्राणिनामग्निः काय इत्यभिधीयते ।

यस्तं चिकित्सेस्तीदन्तं स वै कायचिकित्सकः ॥ Bhoja : Quoted by Śivadīsa Sena in his Commentary on Caraka : *Sutra* 30 : 28.

2. मरीचिरुवाच—अग्निरेव शरीरे पित्तान्तर्गतः कुपिताकुपितः शुभाशुभानि करोति । Caraka : *Sutra* 12 : 11.
3. पित्तान्तर्गत इति वचनेन शरीरे ज्वालादियुक्तवह्नियेषेन पित्तोभूर्पत्य वह्ने सद्ग्रावं दर्शयति । Cakrapāṇi on Caraka : *Sutra* 12 : 11.
4. दहनं दाहः, पचनं पाकः, आहारादेः । Dalhana on Suśruta : *Sutra* 21 : 9.

is known as *antarāgni*."<sup>1</sup> It may be necessary in this connection to make a passing reference to the controversies as regards the identity of *pitta* and *agni*, referred to by Dālhaṇa and Cakrapāṇi in their commentaries on the passage from *Suśruta Saṁhitā*, under reference as well as the *ṭīkā* of *Vijayarakṣita* in his *Madhukoṣa vyākhyā* in the chapter on *Kṣudraroga* of *Mādhyava Nidāna*. Without going into details of the controversy, which appear to have involved logical subtilities, divorced from objective realities for the settlement of an obvious fact, about which Suśruta himself has been very categorical, it may be stated that *Vijayarakṣita* has closed the controversy by quoting Bhoja as follows—

पित्तस्य तेजोऽश पूर्व पाचकः—तदाह भोऽभः—  
 “इदमूप्तोचितं द्वेतत् पित्तोप्मा पचतीति यत् ।  
 मूर्च्छितो रसवीर्याभ्यां समानव्यानसंहितः ॥”  
 हृत्यारभ्य—तस्मात्तेजोमयं पित्तं पित्तोप्मा यः सपक्षिमान्  
 स कायग्निः स कायोप्मा स पक्ता स च जीवनः ।<sup>2</sup>

The controversies such as one under mention would appear to have been the fashion of the day—indulgence in logical polemics. Such fashions prevalent in his days should have upset Vācaspati Miśra, so much that he was constrained to observe that “Lovers of *tarka*, often seek to perceive even the perceptible things by inference.”<sup>3</sup>

However, the various issues raised in this regard by Bhāva Miśra—for and against—are furnished in the Appendix VI.

Neither Caraka and his commentator Cakrapāṇi, nor Suśruta or Vāgbhaṭa, appear to have had any doubt as to the part played by *pitta* in *pacana* and *dahana karmas* with which the production of heat is associated. No doubt, *pitta* is instrumental or better still the factor responsible for bringing about the *saṁghātabheda* of *āhāradravyas*, which serve as

1. तत्र जिज्ञास्य किं पित्तव्यतिरेकादन्योऽग्निः ? आहोस्त्वत् पित्तमेवाग्निरिति ?  
 अत्रोच्यते न खलु पित्तव्यतिरेकादन्योऽग्निरुपलभ्यते, आननेयत्वात् पित्ते  
 दहनपत्तनादिष्वभिप्रवर्त्मानेऽग्निरुद्दुपचारः कियतेऽन्तरग्निरिति… ।

Suśruta : Sutra 21 : 9.

2. Quoted in *Madhukoṣa* on *Mādhyava Nidāna* : 55 : 32.

3. प्रत्यक्षपरिकलितमपि अनुमानेन दुमुक्षन्ते तकरसिकाः । (Vācaspati Miśra).

*indhana* and are burnt releasing in the process, *uṣmā* or heat. Hence, in the final analysis *pitta* is the cause for the production of heat out of the *indhana* ( fuel ) represented by *āhāra* and therefore *pitta* would appear to be the *nimittakāraṇa*, *indhana* the *upādānakāraṇa*; and *uṣmā* the *kārya*. The logic and validity of this conclusion will be shown at a latter stage.

A careful study of the existing editions of ancient Āyurvedic classics and allied literature shows that *pitta* performs functions similar to those of *agni*. The employment of the agency of physical fire in the cooking of food will serve as an effective illustration.<sup>1</sup> The cooking of food with the help of fire is meant to render the former fit for ingestion and digestion. In other words, the heat employed to cook food substance loosens the molecules of the food material. A parallel to this idea is the employment of the agency of fire ( heat ) in our chemistry laboratories to bring about the decomposition and disintegration of substances as well as to speed-up chemical reactions. The idea that underlies the fire-like action of *pitta* has to be considered in the light of the foregoing.

Further, a proper appreciation of the physical structure ( Composition ) of *pitta* described in terms of *pañcabhūtas* may go a long way in the clarification of the *āgneyaguṇa* of this factor. According to Caraka, Suśruta and Vāgbhaṭa, the composition of *pitta* is dominated by *agnibhūta*.<sup>2</sup> Caraka, as well as Vāgbhaṭa have stated that *pitta* is the fluid ( *sūra* ) and liquid ( *drava* ). The latter two qualities of *pitta* have been attributed to the preponderance of *ap-bhūta* also, in the *pañca-*

1. ( a ) एवं रसमलायान्नमाशयस्यमधःस्थितः ।

पचत्यग्निर्याद्यास्थायामोदनायाम्बुतण्डुलम् ॥ Caraka : Cikitsā 15 : 8.

( b ) सन्धुक्षितः समानेन पचत्यामाशयस्थितम् ।

औदर्याग्निर्याद्या वाशस्थालीस्यं तोयतण्डुलम् ॥ Aṣṭāṅgahṛdaya :

Śārīra 3 : 56..

2. ( a ) Caraka : Śārīra 7 : 16.

( b ) पित्तमान्नेयम् । Suśruta : Sūtra 42 : 5.

( c ) Aṣṭāṅgasamgraha : Sūtra 20.

*bhautic* composition of this factor.<sup>1</sup> Vāgbhaṭa has clearly stated that *pitta* is *pañcabhautic* and it is *drava* in consistency, inspite of which, it performs actions, similar to *anala* (fire-like), in the course of the process of digestion, largely due to the actualisation of its *tejas* component (discarding its liquidity—*dravatva*). This fact is inferred from the way in which it performs *pākādi karmas*, viz., it digests food, separates *sāra* from *kitṭa* of the food. It is because of this, it is known as *pācakapitta*.<sup>2</sup> By implication, the *pitta* complex would appear to contain as one of its essential constituent elements, a substance possessing *āgneya-guṇa* by virtue of which it (the *pitta*) is able to perform various chemical actions, implied in the process of digestion of food.

The concept of *agni* of *Ayurveda*, which refers to the manifold functions ascribed to *pitta* is at once comprehensive. It not only includes chemical agencies responsible for *āhārapacana* in the *koṣṭha* (corresponding to gastro-intestinal digestion), which leads to separation of *sārabhāga* (nutrient fraction) of the *āhāra* (food) from the *kitṭabhāga*<sup>3</sup> (the indigestible or undigested residue of the food) but also metabolic events—energy, synthesis and maintenance metabolism. In addition, it is seen to comprehend photo and chemo synthetic processes. *Pācakapitta* known variously as *jāṭharāgni*, *koṣṭhāgni*, *antaragni*, *pācakāgni* and *dehāgni* etc.; while being located in its own place in an area between *āmaśaya* and *pakvāśaya*,<sup>4</sup> directly participates in the digestion of food and at the same time, lends support to and augments the functions of the remaining *pittas*, present elsewhere in the body.<sup>5</sup> The reference here, obviously relates to the remaining *pittas* viz., *rañjaka*, *sādhaka*,

1. ....रसरधिरवसाकफपित्तमूवस्वेदादि तदाप्यम् ।

....यत् पित्तमूष्मा च यो वा च भाः शरीरे तत्सर्वमानेयम् । *Caraka : Sārira* 7 : 16.

2. पञ्चभूतात्मकत्वेऽपि यत्तेजसगुणोदयात् ।

त्यक्तद्रवत्वं पाकादि कर्मणानलश्चिदितम् ॥ *Aṣṭāṅgahṛdaya : Sutra* 12 : 10.

4. पञ्चत्यन्नं विभजते सारकिण्ठौ पृथक्तया । *Aṣṭāṅgahṛdaya : Sutra* 12 : 11.

3. तत्र पक्वाणामाशयमध्यगम् ॥ ( *Ibid* 10 ).

5. तत्रस्यमेव पित्तानां शेषाणामप्यनुग्रहम् ।

करोति बलदानेन पाचकं नाम तत्सूतम् ॥ *Aṣṭāṅgahṛdaya : Sutra* 12 : 10.

ālocaka and bhrūjaka. It is held that the *pācakapitta* contributes moieties of itself to the seven *dhātvagnis*, and supports and augments the function of the latter.<sup>1</sup>

It would be seen from the foregoing that the Āyurvedic concept of *agni* includes, not only five kinds of *pittas* but also, the *dhātvagnis* and *bhūtāgnis*. It is clear from the classical Āyurvedic texts that the enumeration of the number of *agnis* (which include *pitta*) varies from author to author. According to *Caraka Saṁhitā*, read together with its main commentary by Cakrapāṇi Datta, the number of *agnis* enumerated are over 13 as shown below—

*antaragni* 1, *bhūtāgni* 5, *dhātvagni* 7. <sup>2</sup>

On the other hand, Suśruta is seen to have described only five *agnis* viz. *Pācakagni*, *rañjakagni*, *ālocakagni*, *sādhakagni* and *bhrājakagni*.<sup>3</sup> There is however an indirect reference in *Suśruta Saṁhitā* to five *bhūtāgnis*, in the brief description made to the transformation, which foodstuffs undergo in the organism.<sup>4</sup> When these five *agnis* are taken into consideration, the total number of *agnis* according to Suśruta would be ten. Vāgbhaṭa is seen to have reckoned

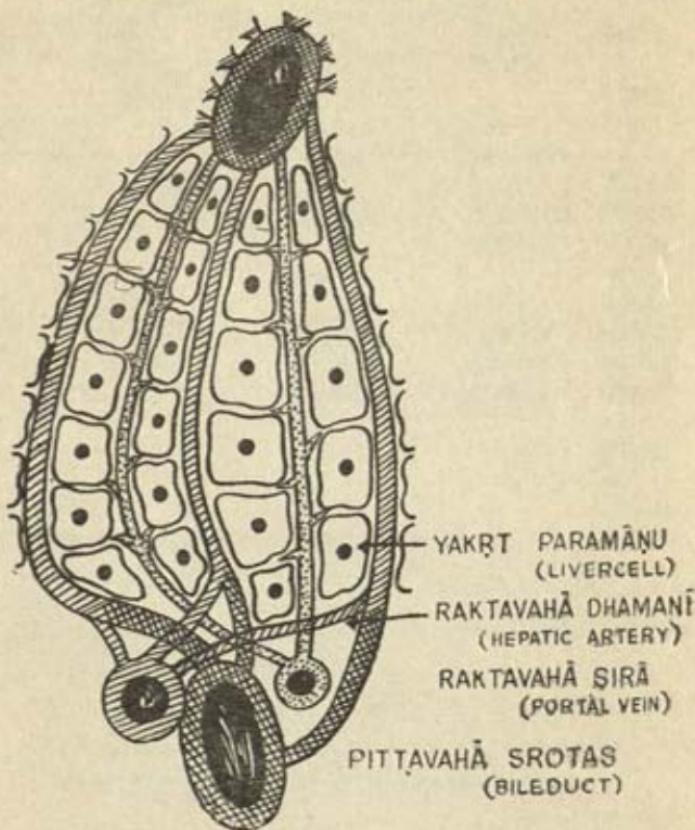
5 *pittas*  
5 *bhūtāgnis*  
7 *dhātvagnis*  
3 *doṣāgnis*  
3 *malāgnis*

in all twentythree *agnis*.<sup>5</sup> Of the more recent authorities, Śāringadhara is seen to have recognised five *pittas* only.<sup>6</sup> On the other hand, Bhāva Miśra is seen to have followed Caraka and Vāgbhaṭa.<sup>7</sup>

1. स्वस्थानस्थस्य कायाम्नेरंशाः धातुपु संस्थिताः ।  
तेषां सादातिरदितिमयां धातुवृद्धिक्षयोऽवम् ॥ *Aṣṭāṅgahṛdaya* : *Sutra* 11 : 34.
2. *Caraka* : *Cikitsā* 15 : 38.
3. *Suśruta* : *Sutra* 21 : 10.
4. पञ्चभूतात्मके देहे द्वाहारः पञ्चभौतिकः ।  
विपक्वः पञ्चधा सम्यक् स्वान् गुणानभिवर्धयेत् ॥ *Suśruta* : *Sutra* 46 : 526.
5. *Aṣṭāṅgahṛdaya* : *Sutra* 12, and *Śārīra* 3.
6. Śāringadhara; *Pervakhaṇḍa* : 5th. Chapter.
7. *Bhāvaprakāśa* : *Prathamakhaṇḍa* : *Śārīra* 3.

## I

## PITTAFORMATION IN YAKṚT





The general physical characteristics and properties of *pitta* or *agni*, as could be gathered from the available editions of the works of Caraka,<sup>1</sup> Suśruta,<sup>2</sup> Kāśyapa,<sup>3</sup> Vāgbhaṭa,<sup>4</sup> Śārangadharā<sup>5</sup> and Bhāva-Miśra<sup>6</sup> are furnished in the table below :

Colour	Consis-tency Density	Taste	Smell	Other pro- perties
<i>Suklāruṇa varja</i> ( Colours other than white and red ).	<i>Sara</i> ( fluid ) <i>Laghu</i>	<i>Katu</i> ( acrid ) <i>Amla</i> ( sour ) normal	<i>Visra</i> fleshy <i>Vai- gandhyā</i> ( un- pleasant ) <i>Tikṣṇa</i> sharp or peni- trating or in- tense or quick in action	<i>Sattva</i> <i>Uṣṇa</i> ( hot ) <i>Tikṣṇa</i> sharp or peni- trating or in- tense or quick in action
<i>Pāṇḍu vivarjita</i> ( all colours other than <i>Pāṇḍu</i> )	<i>Īṣat</i> or <i>anatisneha</i> ( slightly viscous )	and when <i>Vidagdha</i> <i>Tikta</i> ( bitter )	<i>Pūti- gandha</i> ( putrid smell )	
<i>Nila and Pita</i> ( Blue and yellow )				

A careful appraisal of the physical characteristics and properties tabulated above, *vis-a-vis pitta* to which they may refer

1. ( a ) स्त्वनेहमुण्डं तीक्ष्णं च द्रवमम्लं सरं कदु ।  
विपरीतशुणैः पितं द्रव्यैराशु प्रशास्यति ॥ Caraka : Sutra 1 : 60.  
( b ) औषधं तैक्ष्णं द्रवत्वमनतिस्त्वेहो वर्णं च शुक्लारुणवर्णं, गन्धश्च  
विक्षः, रसी च कदुकाम्लै सरत्वं च पित्तस्यात्मरूपाणि ।  
Caraka : Sutra 20 : 15.
2. पितं तीक्ष्णं द्रवं पूति नीलं पीतं तथैव च ।  
उण्डं कटुरसं चैव विदग्धं चाम्लमेव च ॥ Suśruta : Sutra 21 : 11.
3. लाघवं तैक्ष्ण्यमौषधं च वर्णं शुक्लारुणाद्वृते ।  
वैगन्धयं कटुकाम्लत्वमीपत्स्त्वेहश्च पित्तजाः ॥ Kāśyapa.
4. पितं स्त्वनेहतीक्ष्णाणं लघुविक्षं सरं द्रवम् । Aṣṭāṅgahṛdaya : Sutra 1 : 11.
5. पित्तमुण्डं द्रवं पीतं नीलं स्त्वगुणोत्तरम् ।  
कटुतिक्तरसं देहं विदग्धं चाम्लती भजेत् ॥  
Śārangadharā : Purvakhanda : 5 : 29.
6. पित्तमुण्डं द्रवं पीतं नीलं स्त्वगुणोत्तरम् ।  
सरं कटुलघुविनश्च तीक्ष्णमम्लं तु पाकतः ॥  
Bhāvaprakāśa : Purvakhanda : 3 : 120.

shows that they are very general in their outlook and may refer in particular to the *pitta* known in modern times as hepatic-bile. However, qualities such as *sara*, *drava*, *uṣṇa* and *tikṣṇa* may pertain to all the *pittas* or *agnis* of the body and, in special, to *pācaka pitta* (complex). As regards the colour, consistency, taste and smell ascribed to *pitta*, such as *śuklā-rūṇavarja* or *pāṇḍuvivarjita*; *anadhika sneha*; *kaṭu* and *amla*; *visragandha*, *vaigandhya* and *pūtigandha*; *nila* and *pita*, it would appear that they have a direct bearing on the more familiar *bile* secreted by the *yakṛt* which as will be shown later may form part of the *acchaphitta* (-complex). This view finds support from the description of *pitta* as the *mala* of *rakta* ( असूजः पित्तम् )<sup>1</sup> and also, the reference made by Caraka<sup>2</sup> and Vāgbhaṭa<sup>3</sup> to *pitta* as the *vikṛti* of *rakta*—both because of its intimate co-existence with and capacity to impair the integrity of *rakta*; also because of the fact that, *pitta* and *rakta* possess nearly identical smell and colour; in addition, the location of these two factors are *yakṛt* (liver) and *plihā* (spleen). This view finds direct corroboration from modern physiological views as regards blood-bile relationship which can be summed up as follows—"The pigment of bile-bilirubin and biliverdin are the essential constituents of the haemoglobin-complex of the erythrocytes. From this point of view, it may be stated that *rakta* is the seat of *pitta*. These two bile pigments are also the waste-products or the *malas* of *rakta*. *Rakta* and *pitta* are stated to have identical colour. The truth of this statement will become evident by taking into consideration the fact that, though bright red in colour, if left undisturbed, the blood separates into two parts—the lower,

1. Caraka : Cikitsa 15 : 18.

2. संयोगाद् दूषणात्तु सामान्याद्वन्धवण्योः ।

रक्तस्य पित्तमास्यातं रक्तपित्तं मनीषिभिः ॥

प्लीहानं च यकृचैव तदविद्याय जायते ( वर्तते ) ।

स्रोतांसि रक्तवाहीनि तन्मूलानि हि देहिनाम् ॥ Caraka : Cikitsa 4 : 9-10.

3. पित्तं रक्तस्य विकृतेः संसर्गाद् दूषणादपि ।

गन्धवण्णनुवृत्तेश्च रक्तेन व्यपदिश्यते ॥

प्रभवत्यसूजः स्थानात्पलीहतो यकृतश्च तत् ।

Aṣṭāṅgahṛdaya : Niḍānasthāna 3 : 3.

contains the cell and is opaque and red, while the upper part is a clear yellow liquid—the plasma. Under the microscope, an enormous number of pale yellow discs—the red blood corpuscles-floating in a colourless clear fluid, can be seen. Although *yellow*, when seen individually, the erythrocytes appear to be red in bulk. The colour of the hepatic-bile is golden-yellow which is largely due to its pigments—bilirubin and biliverdin. When set free into the blood, the bilirubin contributes to the normal colour of the plasma. Both bile and blood have nearly the same characteristic fleshy smell. In addition, both blood and bile are intimately connected with the liver and spleen.

Therefore, the correlation of *pitta* and *rakta*, referred to in Āyurvedic classics, may represent the summation of the normal relationship that exists between blood and some of the important constituents of bile. This can be seen from the fact, that the formation of bile consists in the removal of bilirubin from blood; its conversion in the liver; its excretion in the bile canaliculi, the reabsorption of it from the intestine in the form of the colourless compound—the stercobilinogen, which latter is utilised by liver cells for the production of fresh haemoglobin. The role of spleen as regards the disposal of the red blood corpuscle can be seen from the fact, that the macrophages present in it, convert the fragmented dust of degenerated red cell into bilirubin, which is transported to the liver where it is utilised for purposes mentioned above.<sup>1</sup>

1. The breakdown and rebuilding of the important constituents of the blood corpuscles, which are being continuously formed and destroyed by the reticulo-endothelial cells, proceed throughout the life of the organism. Erythrocytes, to a large extent, undergo destruction in the blood stream due to stresses and strains to which they are subjected during their passage through blood vessels. At last, becoming aged, they are not able to withstand different kinds of stresses and strains to which they are exposed—they undergo fragmentation. Fragments of different shapes and varying in size, from that of a half or quarter

Additional support to this view is derived from the reference made by all the ancient authorities of *Ayurveda* to the symptomatology of *pittayddhi*, viz., yellowness of urine, faeces, eyes and skin, increased appetite, thirst, burning sensation in the body and insomnia.<sup>1</sup> These symptoms, especially, yellow colour of the urine, faeces, skin and eyes are stated, by modern physiology, to be due to the circulation, in excess, of the pigment bilirubin a condition described as bilirubinemea. It is significant to note that Cakrapāṇi Datta in his commentary on Caraka's description of *śākhāśrita kamalā* has observed that, the non-excretion of *pitta* (which imparts to faeces

of the whole cell to mere dust-like remnants containing haemoglobin (haemoconia) are to be found circulating in the blood, spleen and to a lesser extent, occasionally in other tissues. From the determination of bile pigment excretion, it has been estimated that in health between seven to ten millions of red cells are destroyed in this way every second. Of course, the same number must be formed afresh by the blood forming tissues. The loss of haemoglobin is between 16 to 24 g. daily. The haemoglobin dust is changed into organic iron and pigment bilirubin. The bilirubin is transported to the liver through the medium of plasma and is slightly changed, during the passage into bile. Part of the bile is excreted into the intestine through the bile duct and in the bowel bilirubin is changed into colourless sterco-bilinogen and stercobilin, which latter gives to the faeces its natural dark colour. The stercobilinogen is reabsorbed into the portal blood-stream and is utilised by the liver for the production of new haemoglobin. Following the bilirubin in the liver it is seen that it is broken down by *Kupffer's* cells and gets converted into bile-pigment-biliverdin which when reduced becomes bilirubin. The protein-free portion is set free into blood, contributing to the yellow tint of the plasma.

(Based on physiological Basis of Medical Practice by Best and Taylor and Human Physiology by Winton and Bayless).

1. पीतविष्णमूत्रनेष्टव्यक्षुत्तद्वाहापनिद्रता । *Aṣṭāṅgahṛdaya : Sutra 11 : 7.*

its characteristic colour—*malarañjaka*) into *kōṣṭha*, is responsible for *śveta varcas* or whitishness of *puriṣa*, in this condition.<sup>1</sup>

The explanation of *śvetavarcas* (corresponding to the whitishness of faeces) in *śākhāśrita kāmalā* (corresponding to obstructive jaundice) finds support from the modern biochemical findings and they focus attention to the substance the non-excretion of which into the intestine (corresponding to the *kōṣṭha* of Āyurveda) causes clay-coloured stool (corresponding to *tilapiṣṭanibha varcas*). According to modern biochemistry, "when bile is totally excluded from the intestinal tract, as a result of severe liver-disfunction, extra-hepaticbiliary obstruction or biliary fistula, lipid absorption is more critical. As a result of total lipid content in faeces in a cholic animal is elevated largely owing to an abundance of salt of fatty acids. The presence of these soaps, chiefly insoluble calcium salts, together with the absence of bile-pigments, result in the characteristic clay-coloured stools seen in biliary obstruction."<sup>2</sup>

It would seem, that the *pitta* to which the physical characteristics and qualities, under discussion are attributed may refer to liver-bile and not others.

An appraisal of the functions, ascribed to *pitta* would lend support to the view expressed above. According to Caraka, who has recorded Mañjī, in his *Samhitā*, as having stated that "Digestion or indigestion, visual perception or impairment of it; the normal or abnormal body temperature; the normal or abnormal colour of the body; courage or fear; anger or cheerfulness; lucidity or confusion of mind and such opposite traits are the functions of *pitta*.<sup>3</sup> According to Suśruta, *pitta*

1. कफसंस्मृच्छतो वायुः स्थानात्पित्तं श्लिष्टेद्वाली ।  
हारिद्रनेत्रमूत्रत्वक् येतवचास्तदा नरः ॥ (Caraka : Cikitsā, 16 : 126 )  
येतवचां इति कोष्ठस्थपित्तस्य मलरञ्जकस्य  
वहिनिर्गमाद्वदेन इलेघमणा येतवचां भवति ॥ (Cakrapāṇi on the above).
2. Abraham White *et al* : Principles of Biochemistry : 1954 Edn. page 458.
3. मरीचिरुकाच :—अग्निरेव शरीरे पित्तान्तर्गतः कुपिताकुपितः शुभाशुभानि कोरुते  
तदग्ना पक्षिमपक्षि दशैनमदशैनं मावामात्रत्वमूमणः प्रकृतिविकृतिवर्णं शीर्य  
भव्यं कोर्धं हर्षं मोहप्रसादमित्येवमादीनि चापराणि इन्द्रानि इति ।  
(Caraka : Sutra 12 : 11.)

in its five varieties, imparts colour (*rāgakṛt*), promotes digestion and metabolism (*paktikṛt*) forms *ojas* (*ojakṛt*) promotes vision (*tejaskṛt*), causes intellect (*medhākṛt*) and body-heat (*uṣmakṛt*).<sup>1</sup> In the opinion of Vāgbhaṭa *pitta* is responsible for the causation of body-heat; it contributes to vision, confers *prabhā* (lustre of the body) and is responsible for *buddhi* and *medhā*, courage or valour and *mārdava* or softness of the body.<sup>2</sup>

The functions attributed to *pitta*, in general, are summed up in the table below :—

Somatic or <i>Sārira</i>	Psychological or <i>Mānasika</i>
Prākṛta or physiological	Vaikṛta or abnormal
production of hunger, appetite, thirst and digestion	Impairment of hunger, appetite, thirst and digestion
Metabolism	Abnormal or subnormal states of metabolism
visual perception	Impairment of visual perception
Haemopoiesis or the colouration of <i>rasa</i> in the process of <i>rakta</i> formation.	Impairment of the formation of <i>rakta</i> . Intellection and intelligence.
production of body-heat and temperature	Abnormal or subnormal temperature.
The colour and lustre of the skin health	Impairment of skin health colour pigmentation
The formation of <i>ojas</i>	Impairment of the formation of <i>ojas</i> .

1. रागपक्तयोजस्तेजोमेषोभ्मकृत् पित्तं पश्चात् प्रविभक्तमधिकमैणा अनुग्रहं करोति ।  
( *Suśruta*: *Sutra* 15 : 4. )
2. .....पित्तं पक्तयमरक्षनैः । क्षुत्तद्वृचिप्रभामेषाभीशीयंतनुमाददेवैः ।  
( *Aṣṭāṅgahṛdaya*: *Sutra* 11 : 2-3 ).

It is obvious that, of the various functions attributed to *pitta*, only a part of it namely, the production of hunger including appetite (*kṣut*), thirst (*tṛḍ*), digestion (*pakti*) may relate to the physical characteristics and qualities, now under discussion, which have been described in the *samhitā granthas*. The discussion of the concerned *pitta* is really a study of *pācaka pitta* as a whole and *accha pitta* in part.

Both Suśruta<sup>1</sup> and Vāgbhaṭa<sup>2</sup> have stated that *pācaka pitta* obtains in an area between the *pakvāśaya* and *āmāśaya*; whereas Caraka<sup>3</sup> has stated in very clear terms that *acchapiṭṭa* is secreted as the food which has acquired *amlabhāva* traverses from the *āmāśaya* to the next lower portion of the *koṣṭha*. It is of importance to note that none of these authorities have made any mention of the colour, consistency, taste etc. of either *pācaka pitta* or *accha pitta*.

Likewise, both Suśruta and Vāgbhaṭa have indicated that the organ known as *grahaṇī* is located between *pakvāśaya* and *āmāśaya* and that (a) the relation that exists between *agni* and *grahaṇī* is reciprocal, i. e., *agni* supports the function of *grahaṇī* and *grahaṇī* supports the function of *agni*; <sup>4</sup> (b) *grahaṇī* is also spoken of as *pittadharā kalā*<sup>5</sup> and it holds the ingested food for the duration of its digestion, before the *kitṭa* or undigested food residue is propelled into the *pakvāśaya*.<sup>6</sup> Vāgbhaṭa has emphasized the latter point and described it as 'grahaṇāt *grahaṇī*'.<sup>7</sup> Suśruta has defined *kalā* as 'dhātvāśayāntaramaryādā';<sup>8</sup> meaning 'kalā' is the structure which intervenes

1. तथा दृष्टुकेन विशेषेण पक्वामाशयमध्यस्यं पित्तं चतुर्विषमन्नपानं पचति ।  
( Suśruta : Sūtra 21 : 10 ).
2. तत्र पक्वामाशयमध्यगम् । ( Aṣṭāṅgahṛdaya : Sūtra 12 : 10 ).
3. परंतु पच्यमानस्य विद्यन्धस्याम्लभावतः ।  
आङ्गोच्चयवमानस्य पित्तमच्छमुदीर्यते ॥ ( Caraka : Cikitsā 15 : 10 ).
4. Aṣṭāṅgahṛdaya : Śūrīra 3 : 53.
5. Suśruta : Uttaratantra 40 : 169, Aṣṭāṅgahṛdaya Śūrīra 3 : 50.  
Aṣṭāṅgasamgraha : Śūrīra 5.
6. Caraka : Cikitsā 15 : 57.
7. Caraka : Cikitsā 15 : 56, Aṣṭāṅgahṛdaya : Śūrīra 3 : 50.
8. Suśruta : Śūrīra 4 : 4, Aṣṭāṅgasamgraha Śūrīra 5.

between *dhātus* and *āśayas*. From available descriptions of this structure, it is seen that *kalā* resembles, in some respects, the semipermeable membrane and in other respects the mucosal lining of hallow visceral organs such as the mouth, oesophagus, small and large intestines. In the present context, the description of *pittadharā kalā* would appear to refer to the lining membranes and in special to the lining membranes of the gastro-intestinal tract extending from the pyloric region, up to the ileo-cecum. In fact, the lining or the mucosal-membrane (including the submucosa) of the intestines—small intestine in this context—represents the demarcation between the underlying *srotāmsi* and *māṃsa dhātu* on the one hand and, the food in the lumen of the gut on the other. In addition, it not only serves the purpose of a covering membrane but also (a) as a system of glands, which provides the necessary digestive enzymes, (b) as the surface, on which, various kinds of digestive reactions take place, and (c) as the surface from which absorption of the digested *āhārarasa* takes place. The *grahani* or *pittadharā kalā*, as it is also called, has been uniquely contrived to meet the foregoing threefold functions.

The significance of this arrangement, in keeping with the observations made by Vāgbhaṭa to *pācakapitta*, its place and functions, and, that of *grahāṇī*,<sup>1</sup> *vis-a-vis pittadharā kalā*

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1. Sri S. C. Dhyani, in his thesis on "*Grahaṇītrogā*" offered for his post-graduate diplomaship in 1956, has effectively shown that, in view of evidence gathered by him from the available editions of *sāṃhitā-granthas* and modern developments in the field of physiology of digestion and metabolism, that the *urdhvā-āmāśaya* is the region of the stomach which extends from the fundus to the pyloric area and *adho-āmāśaya* is the region which extends from the pyloric-actrum to the ileo-occum. He has, also, defined the latter portion as *grahāṇī*, in view of the fact that (1) the pyloric sphincter, at the outset, retains the food in the stomach for the duration of gastric digestion and the production of acidified chyme; (2) the duodenum exercises a regulating control over the secretion of some of the important digestive juices and gastric activities. The remaining portion

and its function as described both by Suśruta and Vāgbhaṭa and lastly Caraka's reference to the physiological events which are stated to take place when *ahāradravyas* which have previously undergone *amlabhāva* in the *ūrdhva-āmāśaya* are passed on to the next lower portion of the *kōṣṭha* leading to the secretion of *accha-pitta*, can be summed up in the light of known facts of anatomy and physiology as follows :—

The *ahāradravyas* of different kinds—*āśita*, *pita*, *līdha* and *khādita*—attain (i) *madhurabhāva*, as soon as they reach *āmāśaya*. This stage of digestion is reminiscent of salivary digestion which is completed in the fundus of the stomach, where the insoluble starch-polysaccharide—is converted to soluble dextrin, under the influence of salivary amylase (ptyalin). Thus, the cooked starch is seen to proceed through the following stages in this reaction :

starch → erythrodextrin → achrodextrin → stable dextrin.

The action of the Salivary amylase is of the nature of *bhinnasamīghāta* or splitting, brought about by hydrolysis. The

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of the area, known as *grahāṇī* is lined with *pittadharā kala*. It provides the essential ingredients of *jāṭharāgnī*, responsible for the completion of *anupūka*, which forms part of *jāṭharāgnī vyāpāra*. In addition, the formation of *sāra* or *annarasa*—chyle, and the separation of it from *kittā*—the undigested residue of the food, takes place in this area. The *sūrabhāga*, corresponding to chyle, is retained in the area for the duration, required for its *sosāya* or absorption, while the *kittā* or the undigested residue of the food is removed and passed on to the *pakvāśaya*—large intestine—under the influence of *samāna vayu*. He has thus shown with convincing evidence that the entire small intestine commencing from the antrum of the pylorus including the pyloric sphincter to ileoceccalsphincter, represent a total entity, spoken of as the *grahāṇī*. Further, he attached significance to the area extending from pylorus and ending with duodenum and showed that this is the operative and controlling part of the entire *grahāṇī* system. ( S. C. Dhyani ; *Grahani Roga Post Graduate Thesis : 1956 : pp. 23-40* ).

final *rasa* or taste of the resultant product, in the upper portion of the *ūrdhva āmāśaya*, is *madhura*.

(ii) This digestion is brought to an end by the secretion of hydrochloric acid. Here is seen to commence the second part of the *avasthāpāka*, when the *āhāra*, is stated to undergo *amlabhbāva*, corresponding to the conversion of insoluble proteins into soluble protein, under the influence of pepsin, in the presence of hydrochloric acid. The protein fraction of the food, proceeds through the following stages :

protein → proteoses → peptons before it is rendered soluble.

The final outcome of the entire gastric digestion is the acidified chyme, which has been characterised by Caraka as *vidagdha*<sup>1</sup>, which term, as interpreted by Cakrapāṇi Datta is *pakvāpakva*<sup>2</sup> or *ktñcitpkva-kiñcidapakva* (i.e. partly digested). The implication of this phase of digestion as described by Caraka and elaborated by Cakrapāṇi Datta is that the *āhāra*, in this state, is not yet fit for absorption and utilisation for *bhūtōgni* and *dhātvagnipāka*.

It is of significance, in this connection to note that Caraka and Vāgbhaṭa have mentioned that *māṁsa rasa* ( muscle-juice ) stimulates *jāṭharāgni*.<sup>3</sup> This suggestion is reminiscent of the modern finding that, the "humoural phase" of the secretion of gastric juice, "depends in some way on the presence together in the stomach of food and gastric juice. It must be the product of the action of the gastric juice on the food which acts as a secretagogue; that this is so is proved by digesting the meat *in vitro* with gastric juice and, then, giving the solution by stomach tube, when the secretion begins almost

1. परन्तु पच्यमानस्य विद्यध्यस्याम्लभावतः ।  
आश्वाच्चयवमानस्य पित्तमच्छमुदीर्यते ॥ ( *Caraka Cikitsā* 15 : 10 ).
2. विद्यध्यस्येति पक्वापक्वस्य— ( *Cakrapāṇi* on above ).
- 3.(a) प्रसहानो रसैः साम्लैमोर्जयेत् पिशिताशिनम् ।  
लघु-तीक्ष्णोष्णाशोषित्वाद् दीपयन्त्याशु तेऽनलम् ॥  
( *Caraka: Cikitsā* 15 : 210 ).
- (b) *Aṣṭāṅgahṛdaya: Cikitsā* 10 : 76.

at once."<sup>1</sup> The humoral substance thus produced by gastric mucosa arising out of the action on the latter by polypeptides, is known as the Gastrin<sup>2</sup> which is considered to be responsible for the profuse secretion of gastric-juice.

Resuming from where we digressed—the digression was necessary to emphasise the fact that the *amlatva* attained by the food, at this stage of *āhāra pacana*, is due to an *amla* factor secreted by the *ūrdhvā-āmāśaya*.<sup>3</sup> Synchronising with the passage down of the *āhāra* which has attained *amlabhāva* into the next lower portion of the *māhāsrotas*, *accha pitta* is stated to be secreted. This is a very significant and, possibly a very early observation in that it has been shown by recent advances in experimental physiology that the acidified chyme as it passes down slowly from the pylorus into the duodenum acts as a secretagogue and stimulates the duodenal glands (Bruner's glands), to secrete a number of internal secretions which in their turn have been shown to be responsible for making available the bile and pancreatic juice to the duodenum for carrying out further digestion of the partly digested chyme. The important internal secretions which are shown to be secreted by duodenal glands, under the influence or acidified chyme are: (i) secretin, (ii) pancreozymin, (iii) cholecystokinin and (iv) entero-gastrone. It has been shown that "the flow of pancreatic juice like the flow of bile is regulated hormonally by the introduction of gastric chyme into duodenum. Pro-secretin granules in the mucosa of the duodenum are apparently activated by the acid of the chyme to yield secretin which enters the circulation to stimulate the acinous tissue of the pancreas and promote the secretion of pancreatic juice."<sup>4</sup> "The secretion of pancreatic juice is

1. Lowatt Evans: Principles of Human Physiology; page 876; 11th edition.
2. There is a controversy, if gastrin is the same as histamine.
3. Modern advances have identified this factor as hydrochloric-acid.
4. Abraham White et al: Principles of Biochemistry, p. 445: Mc Graw Hill Publication 1954.

under both neural and hormonal control. The presence of secretagogue or acid in the upper duodenum results in the liberation into the circulation of a hormone—secretin—which stimulates the flow of pancreatic juice. Since secretin is effective in the atropinised animal as well as after a section of vagus a direct action of the hormone on the secretory cells may be assumed. The pancreatic juice obtained after secretin stimulation is copious in volume relatively deficient in enzyme action and of normal electrolytic composition... Secretin also enhances the secretion of bile and intestinal juice.<sup>1</sup>.....“A second intestinal hormone—pancreozymin—which unlike secretin, stimulates the secretion of enzymes by the pancreas, has been stated to occur in intestinal mucosa.....”<sup>2</sup> “The contraction of gall bladder is apparently under hormonal regulation; the hormone cholecystokinin, arising in the upper segment of the small intestine and entering the circulation, when fatty foods are introduced into this portion of the intestine.....results in the prompt contraction of the normal gall bladder and discharge of its contents.”<sup>3</sup> “Emptying of the gall bladder occurs only under the influence of partially digested food in the intestine. This seems to be under neural control, but contraction and emptying of the gall bladder may be observed after complete denervation of the organ and introduction of partially hydrolysed lipid into duodenum. Acid extracts of duodenal mucosa contain a material called cholecystokinin, believed to be a hormone, released by small intestine.<sup>4</sup> “Of particular interest in this connection is the inhibition of gastric secretion which results from the presence of sufficient quantities of lipid in the upper duodenum. Since this inhibition is also manifest in subcutaneously transplanted gastric pouches the effect has been ascribed to a hormone—enterogastrone.”<sup>5</sup> A mention has to be made in this connection to the humoral regulation of intestinal juice; “It has

1. Abraham White *et al* : *op. cit.*, p. 751.

2. *Ibid.*, p. 751-752.

3. *Ibid.*, p. 454.

4. *Ibid.*, p. 754.

5. *Ibid.*, p. 749.

been established that the presence of chyme in the small intestine calls forth still another hormone.....This one has been labelled as enterocrinin and it is thought to be a potent stimulator of the cells which manufacture intestinal juice."<sup>1</sup> It has been shown by Grossman that suitably prepared extracts increase the rate of succus-entericus secretion by the jejunum and ileum and also, increase the enzyme component of the secretion.<sup>2</sup>

The table below will furnish the entire picture of the hormonal control of the *ūrdhva āmāśaya* and the first upper segment of the *grahaṇī*.<sup>3</sup>

Endocrine glands and hormones	Principal site of action	Principal processes affected
Secretin	Pancreas	Secretion of alkali and fluid.
Pancreozymin	Pancreas	Secretion of digestive enzymes
Cholocystokinin	Gall bladder	Secretion and emptying
Enterogastrone	Stomach	Inhibition of mobility and secretion
Gastrin	Stomach	Secretion of acid

From the foregoing experimental observations, cited from more recent advances, it would seem that the *vidagdhāhāra* from the *āmāśaya*, which is *amla* in *rasa*, stimulates the humoural mechanism, located in the upper segment of *adho-āmāśaya* and the discharge of *accha pitta* into this area. The term *accha* has been interpreted by Cakrapāṇi Datta and Gaṅgādhara Sena as *aghana* and *svaccha*, meaning thin and clear respectively.<sup>4</sup> It

1. Langley and Chiraskin : The physiology of Man : page 409. Mc Graw Hill Publication, 1934.
2. Grossman M. I. Physio, Revs, 30, 33, 1950.
3. Abraham White *et al* : Principles of Biochemistry : p. 871. Mc Graw Hill Publication, 1954.
- 4.(a) Cakrapāṇi Datta on *Caraka* : *Cikitsā* 15 : 10.  
(b) Gaṅgādhara Sena on the same.

is obvious that the concept of *acchapitta* includes the gall bladder bile and pancreatic juice, which together have been shown to be responsible for proceeding with further stages of digestion of fats, proteins and carbohydrates in the small intestine. This concept may also include the activities of the intestinal juice, viz., *succus-entericus*. *Acchapitta* would, therefore represent a total concept; possibly it forms part of the much wider concept—*jātharāgni* (*koṣṭhāgni* or *pācakapitta*).

The facts reviewed above represent but one aspect of the concept of *pācakāgni* or *pācaka pitta* which may have to be studied with the structure known as *grahaṇī vis-a-vis, pitta* (agni-) *dharā kalā*, described both by Suśruta and Vāgbhaṭa. There still remains another and perhaps, a major aspect of this concept, which is of fundamental importance. It relates to the observation made by all the three main authors of Āyurveda (*Vṛddhahṛayī*) that *antarāgni* contributes to and augments the functions of other *agnis*, which are found elsewhere, in the body. For example, says Caraka, *koṣṭhāgni* is considered to be the leader of all factors concerned with metabolism in the body. They are all derived from it. Their activities or otherwise, are dependent upon an increase or decrease as the case may be of *jātharāgni*.<sup>1</sup> Says Suśruta, “by a dispensation which is unseen (a cause which can not be perceived or explained and which is hidden), *pitta* which is located in an area between *āmāśaya* and *pakvāśaya*, is responsible for the digestion of four kinds of food ingested by living beings and the elimination of the residue in the form of urine and faeces after the completion of the process. Located as it is in its own place (between *āmāśaya* and *pakvāśaya*) it contributes to and augments the functions of other locations of *pittas*, in the performance of actions. This *pitta* is, therefore, spoken of as *pācakāgni*.<sup>2</sup> Says

1. अन्नस्य पक्ता सर्वेषां पक्तगामधिपो मतः ।

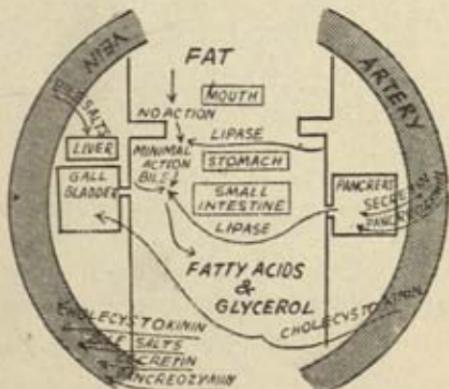
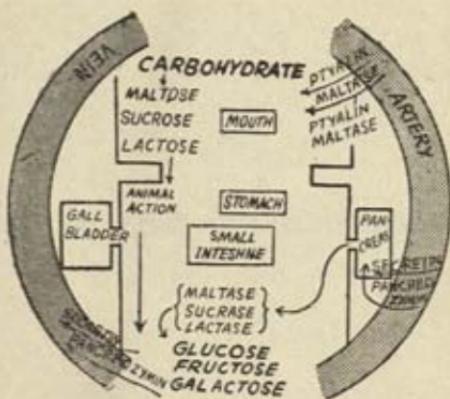
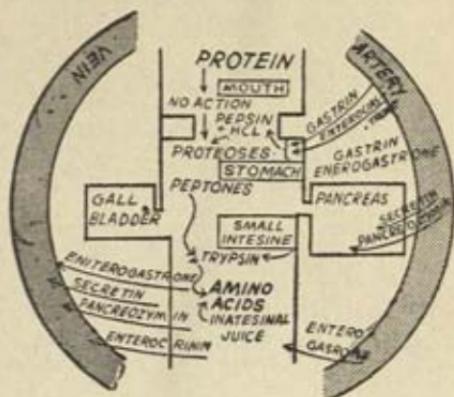
तन्मूलास्ते हि तदृदिक्षयवृद्धिक्षयात्मकाः ॥ ( *Caraka : Cikitsa 15 : 39* ).

2. तच्चाहृष्टेतुकेन विशेषेण पक्वामाशयमध्यस्थं पित्तं चतुर्विधमन्नपानं पचति, विवेचयति च दोषरसमूत्पुरीषाणि तत्रस्थमेव चात्मशक्तयाशेषाणां पित्तस्थानानां शरीरस्याद्विकर्मणा अनुग्रहं करोति, तस्मिन् पित्ते पाचकोऽस्त्रिरिति संशा ।

( *Suśruta : Sutra 21 : 10* ).

## II

## PĀKA OF DIFFERENT TYPES OF FOOD





Vāgbhaṭa, in his *Aṣṭāṅgahṛdaya*<sup>1</sup> and *saṃgraha*<sup>2</sup> that the *pitta*, located between *pakvāśaya* and *āmāśaya*, is *pāñcabhautika* and a *drava* inspite of which it performs actions like *anala* or fire, largely due to the predominance of its *tejas* component over the remaining members of the *bhūta* pentad that composes it. This fact is inferred from the way in which it performs *pūkūdi karmas*, such as the digestion of food and separation of *sāra* from *kitṭa*. In addition, while being located in its own place, it contributes to and augments the functions of other *pittas* elsewhere in the body.

In the chapter “*Doṣādvijñāniya*” of his “*Saṃgraha*”, Vāgbhaṭa has stated that : “A decrease or an increase of the *dhātus*, occur, according as the *tikṣṇatā* or the *mandatā* of the aspects of *pācakāgni*, present in the *dhātus*.

“As the flame of the forest fire tends to increase or decrease, according to the quantity ( more or less as the case may be ) of the *indhana* ( available in the proximity ), so also is the case with *dhātuparamparā*. *Dravyas* are either *tūlya* or *viśiṣṭa*, which cause an increase or decrease, as the case may be, of the *dhātus* due to properties potentially inherited by them, as in the case of a seed ; “homologous properties of *dravyas* cause sufficient and rapid increase of identical or homologous properties in the *dhātus*.” <sup>3</sup>

1. पंचभूतात्मकव्येऽपि यत्तैजससुगुणोदयात् ।  
त्वक्तद्रवत्तं पाकादिकमैग्नाइनलशब्दितम् ॥  
पचत्यनं विभजते सारकिंडौ पृथक् तथा ।  
करोति बलदानेन पाचकं नाम तत्सूतम् ॥

( *Aṣṭāṅgahṛdaya*: *Sūtra* 12 : 10-12 ).

2. *Aṣṭāṅga-saṃgraha*: 20 : 5.  
3. ये पाचकांशा भातुस्थास्तेषां मानवातिनैरुप्यतः ।  
वृद्धिः क्षयश्च भातूनां जायते शृणु चापरम् ॥  
पारम्पर्येऽपि दावामैस्तत्त्वाव्येन्वनं शिखा ।  
वृद्धिक्षयौ यथा याति तथा भातुपरम्परा ॥  
द्रव्यं तु त्वयं विशिष्टं हि स्वं स्वं वृद्धये क्षयाय च ।  
प्रस्यात्मवीजनैर्स्तमात् भृशमाशु च जायते ॥

( *Aṣṭāṅga-saṃgraha*: *Sūtra* 19 : 16-18 ).

Scheme representing the relationship between *Pācakāgni* and other *Pittas* and *Agnis* of the body :

<i>Bhrājaka</i> <i>Pitta</i>	<i>Ālocaka</i> <i>Pitta</i>	<i>Rāñjaka</i> <i>Pitta</i>	<i>Sādhaka</i> <i>Pitta</i>
<i>Pācakāgni in Koṣṭha</i> (Producing <i>annarasa</i> )			
<i>Rasadhātvagni</i> <i>Pācakāṁśa</i> <i>Sthāyirasa</i>			<i>Sukradhātvagni</i> <i>Pācakāṁśa</i> <i>Sthāyiśukra</i>
<i>Raktadhātvagni</i> <i>Pācakāṁśa</i> <i>Sthāyirakta</i>			<i>Majjadhātvagni</i> <i>Pācakāṁśa</i> <i>Sthāyimajjā</i>
<i>Mātusadhātvagni</i> <i>Pācakāṁśa</i> <i>Sthāyimamsa</i>		<i>Asthidhātvagni</i> <i>Pācakāṁśa</i> <i>Sthāyasthi</i>	
			<i>Medodhātvagni</i> <i>Pācakāṁśa</i> <i>Sthāyimedas.</i>

Again in *Aṣṭāṅgahṛdaya*, he has summed up the earlier *Samgraha* version quoted above in the following terms :

“Moieties of *kāyāgni*, which is located in its own place are distributed to and permeate through all the *dhātus*; a decrease of it makes for an increase of the *dhātus*, while an increase of it makes for the decrease of the *dhātus*.<sup>1</sup>”

These two references, studied together, with the reference from *Caraka Samhitā* that “*Pācakāgni* is the leader of all *agnis*” open out many and far-reaching possibilities. Stated in brief these references envisage a generic and intimate relationship that is stated to exist between the *pācaka pitta* (*agni*) located between the *umāśaya* and *pakvāśaya* on the one hand

1. स्वस्थानस्थस्य कायामेरंशः धातुपु संस्थिताः ।

तेषां सादातिदौस्त्रिम्यां धातुवृद्धिक्षयोऽवः ॥

( *Aṣṭāṅgahṛdaya: Sutra 21 : 34* ).

and, the *amīśas* of it present in the *dhātus* on the other. The increase of the one (quantitative and functional), would appear to determine an increase *paripassu* of the other. The outcome of an increase or decrease as the case may be of the *pācakāmīśas* in the *dhātus*, would appear to make for a decrease or increase of the *dhātus* respectively, subject of course to the availability or otherwise of *indhana*, represented by *poṣakadravyas*. This has been illustrated with the simile of the forest fire and the availability of the fuel in the proximity of the fire. If the nutrition available in the proximity is homologous to the *dhātu*, which is to be nourished by it, then, the *pācakāmīśa* aids the normal process of *dhātuvyāddhi*. If, on the other hand, the *poṣakadravyas* is not *tulya* (i.e., it is non-homologous) and is *viśiṣṭa*, then, *dhātus* undergo *kṣaya*—the *pācakāmīśas* corresponding to forest fire consumes or destroys the *dhātus* themselves. The analogy, here relates to the scarcity of nutrition homologous to the tissues which in effect can be compared to scarcely vegetated forest where one of the two things may happen viz., the complete consumption of the available trees and the final extinction of the fire itself or if the jungle is densely vegetated the fire would spread throughout and destroy the jungle. The same is the case with *pācakāmīśas* in the *dhātus*, where suitable *indhana* is either deficient or is not available, the *pācakāmīśa* in the *dhātus* may burn the *dhātus* themselves—thus, making for their *kṣaya*. If on the other hand, there is a deficiency in the *dhātus* of the *pācakāmīśas*, then, in this view, there may be a *vṛddhi* or increase of the *dhātus*.

The idea underlying the classical description of the behaviour of the *pācakāmīśas* in the *dhātus*, in the two circumstances stated above, can be illustrated with the example of the conditions described as *atyagni*—known also as *bhasmaka*, and *mandagni* corresponding in modern parlance to hyper and hypo-metabolism respectively. The former condition is usually associated with hyper-thyroidism which as is well known is marked by a gradual increase or speeded up cellular respiration. This results in the liberation of so much of heat that the affected subject feels hot all the time. In spite of

voracious eating so much of food is burnt that the body weight may decrease; the patient is constantly under nervous tension, highly irritable by stimuli and yet unable to do sustained work due to the lack of fuel reserve and suffers retarded growth. The symptoms of the analogous *tikṣṇāgni* in the patient is that he easily digests even a very heavy meal in a very short space of time. Inspite of his all too frequent and heavy meal he continues to suffer from voracious hunger, parched throat, palate and lips and other discomforts due to it.<sup>1</sup> The latter (hypometabolism) corresponding to *mandagni* can be illustrated with low thyroxin availability—thyroxin activates cellular oxidative processes throughout the body and an insufficiency of this hormone has been shown to be followed by a reduction in the oxidative reaction,—the B. M. R. may fall to 25%. The other related symptoms of the condition are: the development of myxodema which is characterised by a reduction of mental and bodily vigour, the loss of sex drive, loss of hair and an abnormal thickening of the skin as if much water has been accumulated in it (oedema); it leads to an increase of body weight, since less food is burnt in the cells and much of it is stored as fat.

In our academic discussions at the Post-Graduate Training Centre, two possibilities as regards the statement that the *anśas* of *pācakāgni* are responsible for *pacana* and *dahana karmas* in the *dhātus*, were examined in detail. The first possibility was an outcome of the preliminary experimental observations made by the professor of *Kāya cikitsā* at Mysore and Jamnagar from 1952 to 1958, on the effect produced by the fresh aqueous extract of the *agni*(*pitta*)*dhara* *kalā* (corresponding to the mucus membrane of the pylorus and duodenum), in cases of *jalodara*.<sup>2</sup> The theoretical basis for

1. स एवामिवर्धमानोऽत्यग्निरित्यमात्रते, स मुदुसुङ्कुः प्रभूतमध्युपयुक्तमन्नमाशुतरं पचति; पाकान्ते च गलतास्वीष्टुशोषपदाहसन्तापाज्ञनयति; (*Suśruta* : *Sūtra* : 35:24). (B) *Caraka* : *Cikitsā* 15 : 217-220.

2. Dwarakanath et al: A brief report on the preliminary observation on the effect of *Agnidharākalaśārī* or a complete aqueous extract of gastric and duodenal mucosa in cases of *śetha* (Oedema) and *jalodara* (asciti) : Antiseptic : July 57.

this experimental observation was the assumption that the *pitta* (*agni*) *dharā kalā* described by both Suśruta and Vāgbhaṭa, may be the same as the mucus membrane of the pylorus and duodenum, in particular and the small intestine in general; the administration of an aqueous extract of this membrane should replace at least for the time being the deficit of *pācakāgni* the deficiency of which is stated to be the main etiological and pathological feature of *udara-roga*.<sup>1</sup> In a large number of cases of *jalodara*, in which *agnidharākalasāra*, as the extract is known was administered, a dramatic clearance of the ascitic fluid through increased micturition was observed coinciding with progressive return of the patient to normal, increased appetite and capacity to digest food were observed. This phenomenon, according to some authorities is due probably to the inhibition as may be exercised by some factor present in the macosal extract of the anti-diuretic hormone of the posterior pituitary for it was seen that the pronounced diuresis noted in these cases, when this extract was administered was not observed when the same extract was administered to normal subjects. In addition, the observations made by Dr. F. I. Tovey<sup>2</sup> showed that in advanced cases of liver cirrhosis with ascitis preparatory administration of duodenal extract for 10 to 15 days followed by 'mersalyl'<sup>3</sup> diuretic response was noted which could not be observed either with the extract or mersalyl alone. There is, therefore, some basis for the belief that some principle in the extract works by counteracting the high secretion and retention of the anti-diuretic hormone which is known to be present in cases with cirrhosis and thus, make it possible for the mercurial diuretic to act on the kidney.<sup>4</sup> On the basis of the foregoing observa-

1. (a) अग्निदोषान्मनुष्याणां रोगसंघाः पृथग्विधाः ।

मलवृद्धया प्रजावन्ते विशेषेणोदराणि तु ॥ ( *Caraka: Cikitsā* 13 : 9 ).

(b) *Asṭāṅgahṛdaya: Nidāna* 12 : 1.

2. Frank I. Tovey : Personal communication to Prof. C. Dwarka-nath ( 1957 ).
3. Mersalyl is a powerful mercurial diuretic.
4. Frank I. Tovey : *Ibid.*

tions, it was suggested that the *pittadharā kalā* may contain, yet, another factor which may regulate the pituitary control over thyroid and its hormone. If this hypothesis can be sustained by experimental and clinical observations then hyper-metabolism associated with thyrotoxicosis, corresponding to *atyagni* or *bhasmaka* and hypo-metabolism, generally associated with such conditions as Simmond's disease (in which there is a low secretion of thyroid hormone) and hypothyroidism may be explained. *Paripassu*, the correlation between *pūcakāgni*, located between *pakvāśaya* and *āmāśaya* and the *pūcakāṁśas* said to be present in the *dhātus* may also be explained.

An alternative possibility has emerged out of the more recent studies and discussions, the author had with his professor, on the significance and the implications of the doctrine, under reference, *vis-a-vis*, the group of enzymes included under the category of *cathepsins*.<sup>1</sup> Cathepsins are proteolytic enzymes, present in all the tissues of the body. There are four of them viz., I, II, III, IV and they are similar to pepsin, trypsin, aminopeptidase and carboxyptidase respectively, in their proteolytic activities. They are seen to be concerned in the break-down of tissue protein into amino acids throughout the body and especially in the liver, spleen and kidney.<sup>2</sup> Authorities, entitled to an opinion consider that some of the enzymes viz. pepsin, trypsin, dipeptidase etc. are cathepsins present in the stomach and intestine. These latter bring about the breakdown of protein into amino acids by hydrolysis. It has been shown that these enzymes may catalise both the breakdown and synthetic reactions. Cathepsins have been shown, both in *vitro* and *in vivo*, to breakdown

1. Cathepsin—(Greek—Kathepsin, to boil down). Any one of the several proteolytic enzymes present in tissue catalyzing the hydrolysis of high molecular weight proteins to protocoses and peptones, and having an optimum pH, between 4 and 5. It is believed that after death the tissues become acid and cathepsin produces autolysis (protcolysis).

'Gould' Medical Dictionary, p. 217 : 1956 edition.

2. West and Todd: Text Book of Biochemistry: Second edition, p. 1049.

proteins into amino-acids by hydrolysis and pepsin and trypsin etc., could synthesise proteins in all cells by dehydration. Generally speaking, conditions of mass action and energetics are such that protein synthesis is appreciable only in living cells, while digestion predominates in the gut.<sup>1</sup> Weisz has observed that all cells contain cathepsin enzymes mediating the synthesis of cellular proteins, after death, when reaction-energy and amino-acid raw materials are no longer supplied, the same enzymes decompose the protein which they originally aided to build. Post-mortem disintegration is partly due to this and partly due to bacterial action.<sup>2</sup> & <sup>3</sup>

Although, little is known about the specific mechanism and enzymes which are responsible for the synthesis of body proteins from amino-acids during growth, regeneration of injured tissue and for the maintenance of tissue mass of the adult animal, none-the-less, recent contributions as regards cathepsins point to the fact that the important proteolytic and hydrolytic enzymes of gastro-intestinal tract and the cathepsins of the tissue belong to the same generic and functional group and the possibility of an interrelationship between the two cannot be ruled out. In any event, these contributions when examined in the light of *pācakāgni* or *pācaka pitta* would appear to suggest that cathepsins in the tissues may represent the *pācakāṁśas*, while the *pācaka pitta* itself continues to be located in the intestine. *Aṣṭāṅga Saṅgraha*'s citation, in this regard, it is considered, can be explained having regard to cathepsins in the tissues and the lack of *indhana* (amino-acid raw material) which may lead to the breakdown or destruction of *dhātus* by hydrolysis.

The foregoing represent an over-all picture of the concept of *pācakāgni* (pitta). As mentioned in pages 43-44 this concept comprehends *jātharāgni* and *bhūtāgni vyāpāra*, which are important, in the context of this thesis, for according to Caraka, the criterion of efficient functioning of *agni* is to be

1. Weisz : Biology : Second edition : pp. 348-349.

2. Ibid. p 61.

3. Cakrapāṇi on Caraka : Śārīra 1 : 50.

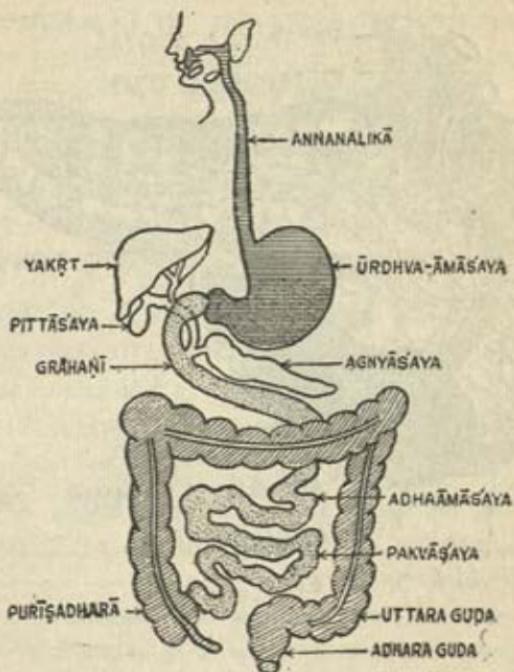
determined by *jarāṇaśakti*<sup>1</sup> or the capacity of the human organism to digest the food ingested in fourfold manner. This has reference to digestive events which take place from the time the food enters the mouth to the time the *sūra* or the nutrient fraction of it is separated from the *kittā* or the undigested residue. These events, in the parlance of modern physiology and biochemistry are salivary, gastric and intestinal digestion. It is not as though these three aspects of digestion are different and unrelated events. They form part of a process represented by distinct phases—each phase contributing to and determining the events of the next succeeding phase. The foregoing are in keeping with the description of *āhārapacanakriyā* in the Āyurvedic classics, which, by the way, derive experimental and clinical confirmation from modern developments in related fields of sciences, as can be seen in what follows.

*Anatomical considerations :—*

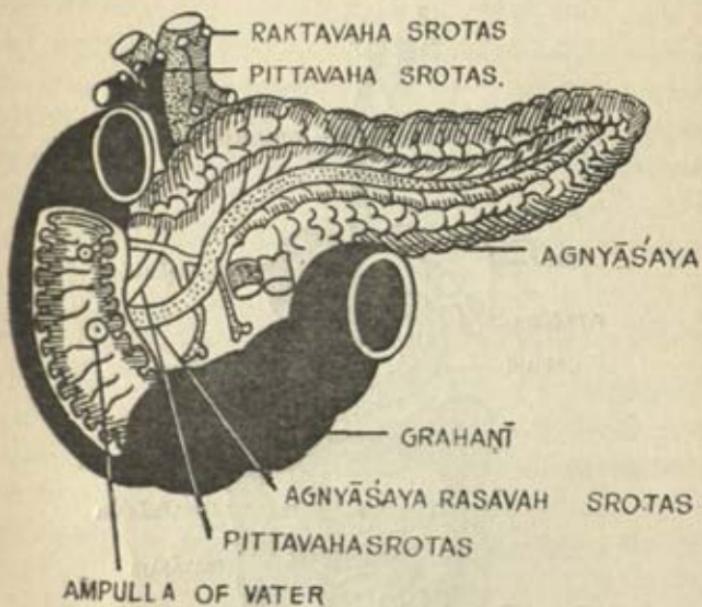
According to Āyurveda, the *mahāsrotas*, corresponding to the alimentary tract, is immediately concerned with the process of alimentation (ingestion and egestion). *Mahāsrotas* is also spoken of as *koṣṭha*. It may be noted here, that the term *koṣṭha* has several synonyms, such as *mahāsrotas* (the great channel), *śarira madhya* (the middle portion of the body or trunk), *mahānimna* (the great cavity), *āmapakvāśaya* (the organ of preliminary and final aspects of digestion) and *ābhyanatararogamārga* (internal pathway of disease).<sup>2</sup> All these terms pertain to the trunk with its great cavity, partitioned into two parts, the *uroguhā* or the thoracic cavity and the *udaraguhā* or the abdominal cavity. In another sense, the *āśayas* contained in them, such as the *nābhi* (umbilicus ?),<sup>3</sup>

1. *Caraka: Vimāna* 4 : 8.
2. कोष्ठः पुनरुच्यते महाक्षोतः, शरीरमध्यं महानिम्नं आमपक्वाशयद्येति पर्याय-  
शब्दः तन्ने । स रोगमार्गः आम्यन्तरः । *Caraka : Sutra* 11 : 48.
3. It is not clear from the available texts—if *nābhi* represents umbilicus or it is an anatomical landmark to indicate an organ or organs contained in the corresponding area of the abdomen. In the view of the author '*nābhi*' when treated as an

III  
DIFFERENT PARTS OF MAHASROTAS



VI  
**GRAHĀṄI AND AGNYĀṄAYA (DISSECTED)**



*hṛdaya* ( heart ), *plihā* ( spleen ), *vṛkka* ( kidneys ), *vasti* ( bladder ), *puriṣadhāra* ( sigmoid colon, known also as pelvic colon ), *āmāśaya* ( stomach and intestine ), *uttaraguda* ( upper segment of the rectum ), *adhoguda* ( the lower segment of the rectum including the anus ), *kṣudrāntra* ( small intestine ), *sthūlāntra* ( large intestine ) and *vapāvahana* ( omentum ).<sup>1</sup>

It would seem from the discussion above that there is a mix up in the enumeration of the anatomical and functional parts, especially of the gastro-intestinal tract, i. e., *koṣṭhāngas*, which when properly classified will work up as follows :—

Anatomical divisions of *mahāsrotas* : *Āmāśaya* ( stomach ), *Kṣudrāntra* ( small intestine ), *uṇḍuka* ( ileo-cecum ), *sthūlāntra* ( large intestine ), *uttaraguda* ( upper segment of the rectum ) and *adhoguda* ( lower segment of the rectum with anus. )

Physiological or functional divisions of *mahāsrotas* : *Āmāśaya* with its two parts viz. *ūrdhva* and *adha-āmāśaya*<sup>2</sup> ( also known as *pacyamānāśaya* ) ( stomach and small intestine including duodenum ), *pakvāśaya* ( large intestine ) and *puriṣadhāra* ( pelvic flexure ending in anus ).

According to Suśruta, the following constitute the *koṣṭha* : the *āmāśaya*, *pakvāśaya*, *agnyāśaya*, *mūtrāśaya*, *raktāśaya*, *hṛdaya*,

organ may correspond to *agnyāśaya*, interpreted as the pancreas. Pancreas, as we know today plays two roles viz. digestive and metabolic—the former relates to important enzymes it contributes to the digestion of proteins, carbohydrates and fats in the small intestine, and the latter, to sugar metabolism. An important organ like pancreas lying immediately above *nābhi* cannot have been missed by the ancient authors of Āyurveda who have mentioned the liver, spleen, kidneys, bladder etc.

1. पञ्चदशकोष्ठानि तथा—नाभिश्च, हृदयं च, कुम्हं च, यकृच, पुरोहा च, वृक्षै च, वस्तिश्च, पुरोषाधारश्च, आमाशयश्च, पक्वाशयश्च, उत्तरगुदं च, अपरगुदं च भुद्रान्तं च स्थूलान्तं च, वपावहनं चेति । ( *Caraka : Sūtra 7 : 10* ).
2. पित्तस्यानेष्वामाशयः इति आमाशयास्याषोमागः । षेषमस्यानेषु आमाशयः इति आमाशयस्योर्ध्वमागः ॥

( *Cakrapāni on Caraka : Sūtra 20 : 8* ).

*uṇḍuka, phuphusa.*<sup>1</sup> This description would appear to be purely functional. It may be noted here that these organs constitute the viscera of the abdomen and thorax. According to this view, functional divisions of *mahāsrotas* will be as follows—*āmāśaya* ( stomach ), *pakvāśaya* ( large intestine ) and *pacyamānāśaya* ( between *āmāśaya* and *pakvāśaya* <sup>2</sup> corresponding to *kṣudrāntra* or small intestine ). The latter is also known as *grahāṇī*. Suśruta<sup>3</sup> has very clearly stated that *āmāśaya* is the seat of *kapha*, whereas, Caraka<sup>4</sup> and Vāgbhaṭa have described *āmāśaya*, not only as the seat of *kapha* but also as that of *pitta*. It is probably with a view to clarifying the position that Cakrapāṇi differentiated *āmāśaya* into two functional parts, viz., *ūrdhva* and *adha-āmāśaya*, which later, he has described as *pacyamānāśaya*.

It is of interest to note that of the fifteen *koṣṭhāngas* described by Caraka and of the eight by Suśruta, *phupphusa* (lung), *āmāśaya* in its two parts—*ūrdhva* and *adha*, the latter correspond to *kṣudrāntra*, *nābhi* ( pancreas ? ), *vṛkka* ( kidney ), *vasti* ( bladder ), *pakvāśaya* ( large intestine ), *puriṣādhāra* ( pelvic colon ), *uttaraguda* and *adhoguda* ( upper and lower segments of rectum ) are seen to be developed from the "primary alimentary tube" laid down in the embryo, as will be seen from the following :—

"The embryonic digestive tube is essentially a blind tube of entoderm as it is first formed. The muscular layer which surrounds the tube is formed secondarily from splanchnic mesoderm. An oral cavity ( or stomodeum ), which will later become the mouth, invaginates from the anterior end of the embryo to meet the anterior end of the entodermal tube. The surface ectoderm is pulled in with this invagination and lines the anterior part of the oral cavity. In the same way a posterior ectodermal invagination pushes in to meet the

1. स्यानान्यामाभिनपक्वानां मूलस्य रुचिरस्य च ।

हुण्डकः फुफ्फुस्य कोष्ठ इत्यभिधीयते ॥ Suśruta : Cikitsa 2 : 12.

2. ( a ) Suśruta : Uttaratantra 40 : 169.

( b ) Suśruta : Sutra 21 : 10.

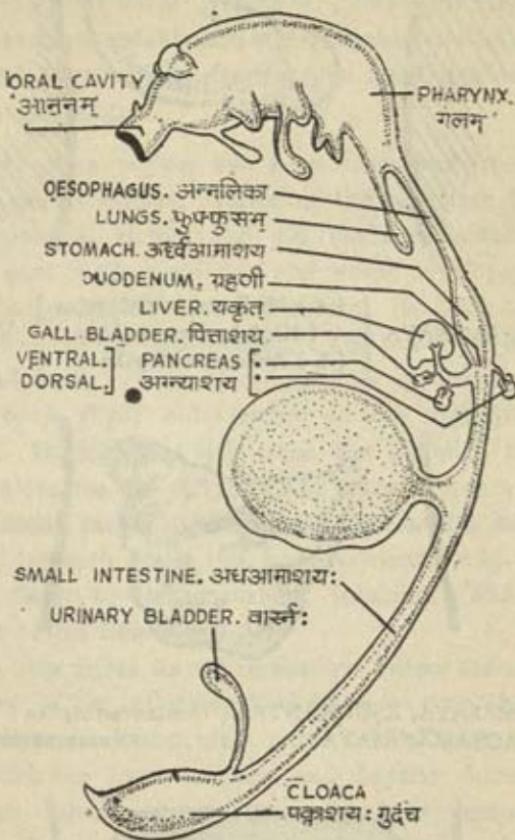
3. मादुर्यांत पिछ्छलत्वाच्च प्रक्लेदित्वात्त्वैव च ।

आमाशये सम्भवति इतेभ्या मधुरशीतलः ॥ Suśruta : Sutra 21 : 13.

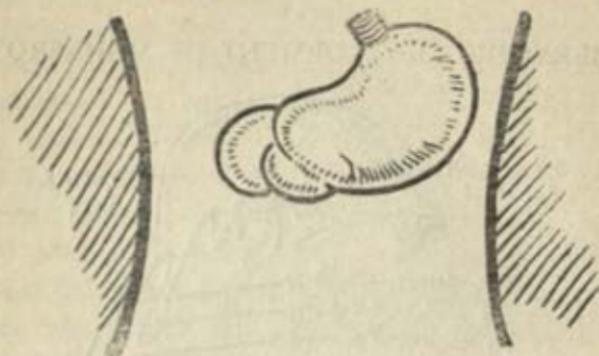
4. Caraka : Sutra 20 : 8.

## IV

## EMBRYONIC DEVELOPMENT OF MAHĀSROTAS



DIFFERENT PARTS OF MAHĀSROTAS  
WITH THEIR SPECIALISED FUNCTIONS

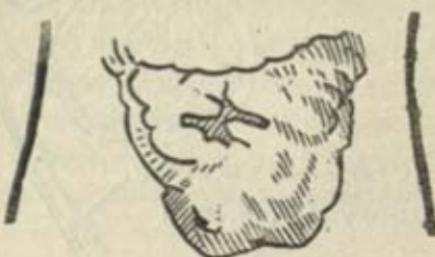


1. ORDHVA-ĀMĀŚAYA

( a ) Madhura Auasthāpāka  
( Kledaka Kaphasthāna )

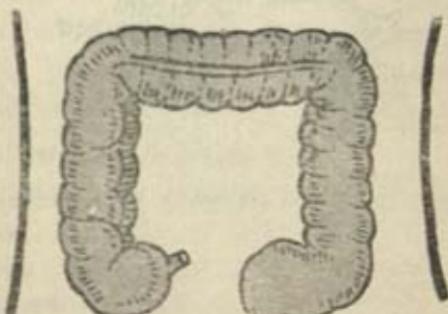
( b ) Amla avasthāpāka

Vidagdha Pāka

2. ADHAĀMĀŚAYA, KṢUDRĀNTRA  
ON PACYAMĀNĀŚAYA

Amlaavasthāpāka ( Contd. )

( Annarasaśoṣana )

3. PAKVĀŚAYA ON  
STHŪLĀNTRA

Kaṭubhāva

( Pāṇḍikarana and Purtṣotpatti )

entodermal tube near its caudal end. The caudal end of the entodermal tube forms a common posterior opening called the *cloaca*. In mature animals that retains the cloaca, such as birds and reptiles, the urinary and reproductive ducts open into this common opening. The human embryonic cloaca soon divides to form the rectum dorsally and urinary bladder and uro-genital sinus ventrally. The urethral and anal canals are soon established and the cloaca disappears. The anal canal by virtue of its origin is lined with an epithelium of ectodermal origin.

The pharynx region has been discussed from the stand point of its derivatives. Certainly the structure derived from the pharyngeal arches and gill clefts constitute a most interesting part of the history of embryonic development.

The pharynx itself is a soft tube at the back of the mouth and leading to the oesophagus. The tonsil lie embedded in its lateral walls. The oesophagus is at first a short tube leading to a slight enlargement in the digestive tube—the stomach. During the fifth week the stomach enlarges and begins to assume the shape of the mature organ. It is originally located rather high in the body cavity, but during the sixth and seventh weeks the body elongates and the stomach appears closer to its permanent location. The oesophagus elongates at this time also.

"The liver arises as a diverticulum below the stomach from the region of the intestine destined to become the duodenum. The entodermal diverticulum grows into a thick walled visicle from which the liver tubesles and hepatic ducts arise. The entodermal ducts grow into splanchnic mesoderm which provides the connective tissue of the liver and its capsule. The posterior portion of the diverticulum gives rise to the gall bladder and cystic duct. The fetal circulatory plan provides that food-laden blood from the placenta shall pass through the liver. The liver becomes proportionately very large in the foetus, accounting for around ten per cent of the body weight in the fetus of nine weeks. The liver is still large at birth but represents approximately only five per cent of the body weight, while in the adult the proportional weight

shrinks to two or three per cent. The liver eventually becomes located below the diaphragm largely on the right side. The stomach lies to the left and is partially covered by the liver.

"Two diverticula from the primitive entodermal tube give rise to the pancreas. One evagination from the dorsal wall becomes the dorsal pancreas and the other evagination from the dorsal wall becomes the ventral pancreas. The duct of the ventral pancreas is associated with the common bile duct. The lengthening of the bile duct and the growth and flexure of the duodenum bring the ventral pancreas to a position directly below the base of the dorsal pancreas, and the two parts fuse in the embryo in seven weeks. The greater part of the mature gland is derived from the dorsal pancreas; and the ventral pancreas forms only the lower basal portion. The dorsal pancreatic duct joins the ventral duct in a manner to retain the base of the ventral duct and its primitive connection with the bile duct. The single duct of the mature pancreas, then joins the common bile duct in the ampulla of *Vater* and empties the pancreatic fluid into the duodenum along with that of liver.

"The intestine at first is a straight tube extending from the stomach to the cloaca. It is held in place by a connective tissue sheath called the mesentery. Anteriorly in the duodenal region there is both a dorsal and a ventral mesentery dividing the body cavity or ceolom into right and left portions. Posteriorly the right and left ceolom form a common cavity. The ceolom, itself arises as a narrow cavity between layers of somatic and splanchnic mesoderm. The transverse septum which latter becomes a part of the diaphragm, separates the plural and cardiac cavities from the abdominal cavity. The lungs and heart occupy the thorasic cavity, and the intestine comes to lie in the abdominal cavity.

The intestine lengthens, forms a loop, and then grows rapidly to form so many coils that the small abdominal cavity apparently cannot contain them. A loop of intestine then pushes out into the umbilical cord at about five weeks. The abdominal cavity continues to enlarge and in the embryo of ten weeks the extended portion is pulled back through the

umbilical ring. The caudal part of the intestine is actually of smaller diameter than the small intestine in the early embryo. At a latter stage in its development as in the fetus of five months, it begins to resemble the large intestine of the new born infant.<sup>1</sup>

"The area immediately posterior to the pharyngeal pouches give rise to a laryngotracheal ridge on its ventral surface in very young embryos. The primordial outgrowth of the larynx and trachea then arises as a bud from the primitive gut in this region. The tracheal bud elongates and branches to form bronchial buds. The whole structure is bilobed and is commonly called the lung bud. The bronchial buds by continued branching from the entire respiratory tree, the bronchial tubes, bronchioles, and alveoli. The bronchial buds are entodermal but they grow into a mass of mesenchyme from which will arise the supporting tissues of the lungs and bronchial tree; only the epithelial lining of the passage ways remain entodermal in origin. The lung buds grow out dorsally and on either side of the heart into that portion of the body cavity which will later become the pleural cavities. The lungs are small at birth since they are never fully expanded with air. While respiratory movements may take place before birth, the lungs are not functional until the new-born infant takes its first grasp of air. The lung tissue may not become completely inflated until several days after birth."<sup>2</sup>

#### AVASTHĀ PĀKA

*Avasthāpāka* refers to changes, which *āhāradrayyas* undergo in the *koṣṭha*. Two phases of it have been described viz. *prapāka* and *vipāka*. *Prapāka* has been defined as *prathama-pāka* or the first outcome of *pāka* or chemical action.<sup>3</sup> *Vipāka* has been defined as the outcome of the action of *jāṭharāgni* on the *āhāra* substrate—the resultant of the previous

1. De Coursey : The Human Organism : 1955 edition, pp. 485-487.

2. Ibid. pp. 487-489.

3. प्रपाकतः इति प्रथमपाकतः । Cakrapāni on Caraka.

*pāka*,<sup>1</sup> i.e. *prathama pāka*, which is to be judged from the point of view of the taste of the end products of gastro-intestinal digestion viz., *madhura* (sweet), *amla* (sour) and *kaṭu* (acrid or pungent).

It has been stated that *dravya* is the basis for *rasa*, *guna*, *virya*, *vipāka* etc., and therefore, it is of fundamental importance.<sup>2</sup> By *dravya* is meant the *anuṣ* or atoms of the *bhūta* pentad. The main mode of the formation of compound substances is stated to proceed as follows: the *adhiṣṭhāna* or basis for the formation of a compound is *prthvi paramāṇu*, *ap* serves as the *yoni* or medium and, *agni*, *pavana* and *nabhas*, align themselves (in varying numbers and modes) in the compound.<sup>3</sup>

It was noted earlier at page 9 that *prthvi*, *ap*, *tejas* and *vāyu*, according to *Nyāya-vaiśeṣika* system have *aṇutva*, i.e., they are finite or atomic. *Ākāśa*, in this view, is *vibhu* (continuum or infinite). They are *kāraṇa dravyas*. But, in the view of *sāṃkhyas*, *paramāṇus* of *prthvi*, *ap*, *tejas*, *vāyu* and *nabhas* are all *kārya dravyas* and they are finite.<sup>4</sup> This is also, the case with *nabhas* which, at the level of *tāmasāḥamikāra*, has been stated to be *vibhu*. In the *Nyāya-vaiśeṣika* sense, the *anuṣ* can neither be created, nor destroyed or altered. They are eternal. In this sense, the *anuṣ* of *Vaiśeṣikas* are *ne-plus-altra*.

It is the number in which different kinds of *bhūta paramāṇus* combine and their spatial relationship with each other, that confers on the compound thus formed, its characteristic *rasa*

1. जाठरेणाभिनना योगाद्युदेति रसान्तरम् ।

रसानां परिणामान्ते स विपाक इति स्मृतः ॥ *Aṣṭāṅgahṛdaya* : *Sutra* 9 : 20.

2. ( a ) द्रव्यमेव रसादोनां श्रेष्ठं ते हि तदाश्रयाः ।

*Aṣṭāṅgahṛdaya* : *Sutra* 9 : 1.

( b ) *Suśruta* : *Sutra* 40 : 15-18.

3. पञ्चभूतात्मकं तत्तु क्षमामधिकाय जायते ।

अम्बुदोन्यभिन्नपवननभसां समवायतः ॥

तत्त्विद्विविशेषश्च ॥

*Aṣṭāṅgahṛdaya* : *Sutra* 9 : 1-2.

4. The *paramāṇus*, in their turn, are stated to be composed by more elementary units of substances spoken of as *tanmātrās* which are five in number: viz. *śabda*, *sparsa*, *repa*, *rasa* and

( taste ), *virya*<sup>1</sup> ( mode of energy viz., *uṣṇa* or kinetic and *śīta* or potential ), *vipāka* ( the outcome of the chemical changes to which the compound is subjected in the body, described in the terms of *rasa* ), *guṇa* ( quality ) and *prabhāva*<sup>2</sup> ( specific and characteristic property which may not be described or explained in terms of *rasa*, *guṇa*, *virya*, *vipāka* ).

Compounds which are formed with the five kinds of *kāraṇadravyas* are *anitya* ( transient ); their qualities and properties are also transitory—they last as long as the combination lasts. *Anus*, contained in a compound belonging to the same species, combining in the same number but in different spatial relationships may appear apparently to be identical in *rasa*, *guṇa*, *virya* and *vipāka*, but their actions in effect may be different and not be explicable from the point of view of *rasa*, *guṇa*, *virya*, *vipāka*. This peculiar and what to the ancient authorities appeared to be an unseen<sup>3</sup> and inconceivable power ( *acintya śakti* ) has been explained by Professor C. Dwarakanath as follows : “Pressing the analogy of modern physico-chemical concept, isomerism, he explained the observed difference in the functional behaviour of two substances, which have an identical atomic structure but the atoms whereof are spatially aligned differently exhibiting distinctly different properties. He illustrated this difference with the example of ammonium cyanate and urea, and also with the common place example or the difference in the meaning and the

*gandha tanmātrās*. These latter are the *kāraṇadravyas*, in relation to the *sthulabहृta paramātrās*, now under reference.

1. ( a ) शीतोष्णमितिवीर्ये तु क्रियते येन या क्रिया ।

नावीर्ये क्रियते क्रिचित्सर्व वीर्यकृता क्रिया ॥ *Caraka* : *Sutra* 26 : 65.

( b ) उणशीतयुणोत्कर्षात्तत्र वीर्ये द्विधा स्मृतम् ।

*Aṣṭāṅgahṛdaya* : *Sutra* 1 : 17. & *Aṣṭāṅgasamgraha* : *Sutra*.

( c ) शक्तयुक्तवीर्येषु शक्तिर्वालोकेऽपि प्रसिद्धः । *Hemāndri* on the above.

2. ( a ) रसादिसाम्ये यत्कर्म विशिष्टं तत्प्रभावजम् ॥

*Aṣṭāṅgahṛdaya* : *Sutra* 9 : 26.

( b ) *Caraka* : *Sutra* 26 : 67.

( c ) *Suśruta* : *Sutra* 40 : 19-21.

( d ) *Aṣṭ. Samgraha* : *Sutra* 17.

3. प्रमात्रोऽचिन्त्य उच्यते । *Caraka* : *Sutra* 26 : 70.

significance of the terms 'God and Dog,' 'Pot and Top,' 'Karma and Amrak' etc." <sup>1</sup>

The digression into the nature of *dravya* became necessary in view of the description of the products which represent the final outcome of the *jātharāgni pūka*, in terms of their *rasa* or taste. The only important point to note here is the fact that changes in *rasa* are directly correlated to changes in the composition of *dravyas*, brought about under the influence of *jātharāgni*.

Thus, the *āhāra pūka* in the *koṣṭha* may be stated to proceed in the following order—

( 1 ) The presence of food in the mouth is followed by the perception of its taste, under the influence of *bodhaka kapha*.

This *kapha* is stated to be present in the tongue

1. *Madhurabhāva* and it enables the perception of taste.<sup>2</sup> The implication of *bodhaka kapha* needs an examination. It is obviously a fluid present in the mouth in which, food substances are dissolved or ionised; for a substance which

1. "According to this concept, substances may possess identity of chemical composition and yet exhibit different properties.

The cases of urea— $\text{C} < \frac{\text{NH}_2}{\text{NH}_2}$  and ammonium cyanate— $\text{NH}_4\text{CNO}$

can be cited as examples of isomerides. Both these compounds have the same molecular formula  $\text{N}_2\text{H}_4\text{CO}$  and yet they are different in their properties. The same is also the case with ethyl ether— $(\text{C}_2\text{H}_5)_2\text{O}$  and butyl alcohol— $\text{C}_4\text{H}_9\text{OH}$ . From these, it will be seen that the chemical composition which largely determines the secondary qualities of substances, such as *rasa*, *guna*, *vīrya* and *vipaka* does not, therefore, uniquely determine a chemical compound. The examples of 'isomerides' effectively illustrate the concept of *prabhava*."

C. Dwarakanath : Fundamental Principles of Āyurveda :

Part III, page 171.

2. ( a ) विद्वामूलकण्ठस्यो विहेन्द्रियस्य सौम्यत्वात् सम्बन्धसंबोधे वर्तते ।

*Suśruta : Sutra 21 : 14.*

- ( b ) रसवोधनात् । वोधको रसनास्थायी ।

*Aṣṭāṅgahṛdaya : Sutra 12 : 17.*

### Chart Furnishing Known Details of *Avasthāpāka*

( 58 )

Avasthā Pāka	Name of the avay-ava where secreted	Glands or cells	Vātā vyāpāra ( Nervous control )	Activated by	Medium for work	Srāva nāma (Name of the secretion)	Substrate	Pariṇāma ( End-Products )	Vipāka	Remarks
								Known Details of Avasthāpaka		
Madhura upto Urdhvabhāga of Urdhva āmāśaya ( Upper portion or fundus of the stomach )	Mukha ( Buccal cavity )	1 Sub-maxillary 2 Sub-lingual 3 Parotid	Āṁśas (Portion) of prāṇa viz. 1. A branch from chordatympani ( Parasympathetic ) 2. Sympathetic from the plexuses around facial artery.	1 Darśana āsvādāna and āghraṇa, etc. of food 2 Mānasika or Psychic	1 6.0 pH 2 45°C Temp.	1 Bodhaka Kapha ( Mucin ) 2 Pācaka Pitta ( Ptylin or salivary amylase )	Cooked and uncooked starch	Soluble starch Erythro dextrin Achrode xtrin Soluble dextrin	Maltose	Vidagdha or arha-pakva
Madhura in the upper portion ( Fundus ) and Amla in the body and lower portion ( Pylorus ), upto the end of Adhoāmāśaya (small intestine )	Urdhva-āmāśaya ( Stomach )	1 Peptic 2 Oxytic 3 Mucoid 4 Surface 5 Castle cells	Āṁśas ( portion ) of Samāna vāyu viz., 1 sympathetic from coeliac ganglion and 2 Parasympathetic from vagus ( 10th cranial ) nerve	1 Reflex phase due to a. Psychic effect b. Distension of the stomach 2 Mechanical stimulation by the presence of food 3 Humoral phase 4 Presence of digestive products in duodenum 5 Chemically ( Gastrin )	1 4-5 pH 2 37°C Temp 3 Presence of HCl helps the function of pepsin	1 Kaledaka kapha 2 Rañjakapitta 3 Pācakapitta a HCl (from oxytic cells ) b Renin c Lipase d Pepsin (from peptic cells)	Ingested diet cane sugar and other sugar, Soluble caseinogen, Fat 1 Protein 2 Collagen 3 Mucin 4 Nucleic acid	( Kledana-bhinnasamgata or disintegration ) changes in structure by which other enzymes can act easily Insoluble caseinogen + calcium = Calcium caseinate Fatty acids and glycerol Acid metaprotein-proteoses and peptones Galactoses and gelatin peptones Peptone-like substance 1 Proteoses and peptones 2 Nucleic acid	Amla	Vidagdha
Amlapāka	Grahanī ( Duodenum )	Agnyāśaya or Pancreas	Āṁśas ( Portion ) of Samāna vāyu viz., Sympathetic from Coeliac ganglion 2 Parasympathetic from Vagus. 3 Intrinsic nerves ( Peripheral Brain )	1 Reflex from the entrance of acidified chyme 2 Humoral a Secretin b Pancreozymin 3 Neural	1 6 pH 2 Trypsin is activated by entrokinase	Pācakapitta viz. 1 Trypsin ( Proteinase ) 2 Chymo Trypsin and carboxy peptidase. 3 Amylase 4 Lipase ( Steap sin ) 5 Milk curdling	1 Protein 2 Elastin 3 Proteoses and Peptones on starch, first acted by HCl Fat Milk	Alkali-meta protein-deutro proteoses, -Peptone -peptone like substances Amino acids Dextrins Fatty acid and glycerol Curdles	Amla	Vidagdha

Avasthā Pāka	Name of the <i>avayava</i> where secreted	Glands or cells	Vāta vyāpāra ( Nervous control )	Activated by	Medium for work	Srāva nāma ( Name of the secretion	Substrate	Pariṇāma ( End-products )	Vipāka	Remarks
Amlapāka ( contd )	Grahanī ( Duodenum )	B Yakṛt ( Liver )	Aṁśas ( Portions ) of Samāna Vāyu viz., Sympathetic and Parasympathetic	1. Neural 2. Chemically by chole-cystokinin		1. Pācakapitta-- a. Bile salts ( Not an enzyme ) b. Malaṛājaka Pitta ( Bile pigment )  Ducrinin etc.*	Large fat droplets.	Emulsified fats ( Small droplets )		Vidagdha
Amlapāka ( contd )	Kṣudrā-ntra ( Small Intestine )	Crypts of Liver-kuhn	Aṁśas ( Portions ) of Samāna Vāyu. Viz, 1. Extrinsic A. Sympathetic B. Parasympathetic 2. Intrinsic A. Auerbach's plexus B. Miessner's plexus ( Which form the Perifecal Brain )	1. Neural 2. Chemical like secretin. 3. Mechanical by presence of food and peristalsis	6. 3 to 8. 6 pH	Pācakapitta viz. 1. Enterokinase 2. Erepsin  3. Invertase of Sucrase 4. Maltase  5. Lactase 6. Peptidase 7. Proteases 8. Lipase 9. Diaminase 10. Arginase 11. Nucleinase 12. Phosphatase	Helps trypsin to complete its work	Glucose and Fructose  Glucose	Glucose and Fructose  Amino acids  Fatty acid and Glycerol	Madhura  Madhura  Madhura Amla Amla Amla
Kaṭupāka	Bṛhadantra or Large Intestine	From Bacteria	Aṁśas ( portion ) of Apāna Vāyu viz., 1. Extrinsic A. Sympathetic B. Parasympathetic 2. Intrinsic A. Meissners plexus B. Auerbach's " ( But nerves are not responsible for Bacterial enzyme secretion )	1. Presence of food 2. Peristalsis	6. 9 to 7. 2 pH	Various Bacterial enzymes	Carbohydrate  Cellulose  Fat  Proteins  Alanin	Lactic acid-carbonic acid Sulphide and Butyric acid.  Carbonic acid + Methane  Valeric and Butyric acid  Peptones and Amino acids  Ammonia, Indol and Skatol  Ethylamine	Amla  Kaṭu  Amla  Kaṭu  Kaṭu	

Foot Note :— \* This Substance together with Anthelone and Villicrinin are found in the gastro-intestinal tract, but they are stated to be not well defined entities. West & Tread: Text Book of Biochemistry: 1955 edn: Page 1293.

can neither dissolve nor ionize cannot invoke the sensation of taste. It is obvious that, since *bodhaka kapha* is a variety of *kapha*, it should possess at least some of the invariable qualities of this *doṣa* viz. the *āpyaguna*. In addition, it should have the capacity to permeate through food and loosen the component particles, so that, they may go into solution.<sup>1</sup> The concept of *bodhaka* parallels the description of saliva, secreted by the salivary glands, especially parotids, which abound in serous cells and which produces a thin watery secretion. It is of course, understood that, the mucus cells, especially, of the sublingual glands, provide a thick substance. These glands, also, provide the enzyme-ptyalin. Thus, saliva, the analogue of *bodhaka* in Āyurveda, performs the following functions<sup>2</sup>—(i) it dissolves some substances, thus making taste possible; (ii) the enzyme content in it begins to act and (iii) it lubricates the food, so that it may be swallowed. The outcome of the action of *bodhaka* on food, especially that fraction of its composition which is essentially *madhura* in taste, is seen to be continued and completed in the upper portion of *ūrdhva īmāśaya* described in the modern anatomy as the fundus of the stomach. By now, the insoluble *madhura* portion of food becomes sufficiently soluble and mixed up with the frothy *kledaka*

1. लालारूपो रसादिभेदान्विभजन् जिह्वारसं गृजाति ।

Āyurvedasūtra : Praśna 1-81.

लालारूपो रसः जिह्वाग्रवच्चिपदार्थं गृजाति । मुक्तान्विभजनं च करोति इत्यर्थः ।

Yogīnandanañtha on the above.

2. It is seen that, even as early as the fifteenth century when Yogīnandanañtha is said to have written his commentary on Āyurveda Sūtra, *lāla* in the mouth, corresponding to *bodhaka kapha* (saliva), described by earlier authorities, perform two functions viz., it enables tasteperception and splits the food in the mouth. The former function was attributed by him to the *ap* or watery component of *lāla* and, the latter, to the potential *tejas* from which *ap* has been stated, by some of the Dārśanika philosophies. Whatever the philosophical interpretation of this phenomenon may be, the fact remains that it was recognised by the medieval Āyurvedic authorities that saliva performs both the functions described above.

*kapha* (mucin) present in the *urdhva āmāśaya*. It is obvious that this fraction of the *āhāra dravya*, which is meant to undergo *amlabhāva* remains in this stage still to be digested and it also becomes mixed up with *kledaka* which latter acts upon it and performs *klinna* (that is to say, it permeates through and loosens the particles.) The *madhura bhāva* of the *avasthāpāka* is now brought to an end, synchronising with the commencement of the second *ayasthā*, namely, *amlabhāva*.

The entire movement of food from mouth to *āmāśaya* is due to the action of *prāṇavāyu*. According to Caraka,<sup>1</sup> Suśruta<sup>2</sup> and Vāgbhaṭa,<sup>3</sup> functions of *prāṇavāyu* include the secretion and spitting of saliva (*śṭhivana*), eructation (*udgūra*) and deglutition (*annapraveśa*). The act of secretion of saliva, according to modern physiology, is due to the stimulation of sympathetic and parasympathetic.

The term *annapraveśa*, translated verbatim, means the entry of food into *āmāśaya* or, in other words, its propulsion into this organ, under the influence of *prāṇavāyu*. Stated in terms of modern physiology, actions ascribed to *prāṇavāyu*, which is stated to be located in the *mūrdhā* or head, resemble those of the autonomous nervous system in general, and parasympathetic in particular, even though the ancient Āyurvedic description includes some functions of the peripheral nervous system also. The deglutition centre is seen to be situated in the medulla-oblongata. These facts are in keeping with the description of *prāṇavāyu* and its location in the *mūrdhā* or head.<sup>4</sup>

The phenomenon of *amlabhāva* was discussed earlier in pages 39-41. This aspect of the *avasthāpāka*, can be seen from contributions made by modern physiology, 2. *Amla bhāva* to correspond to peptic digestion of proteins and it does not appear to have anything to do with the digestion of substances which possess *madhura*

1. श्वीवनक्षवयूद्धारथासाहारादि कर्म च । *Caraka* : *Cikitsa* 28 : 6.

2. सोऽनं प्रवेश्यत्वन्तः प्राणश्चाप्यवलन्वते । *Suśruta* : *Nidāna* 1 : 13.

3. उरःकण्ठचरो दुद्धिहृदयेन्द्रियचित्तधृक् ।

श्वीवनक्षवयूद्धारनिःथासामप्रवेशकृत ॥ *Aṣṭāṅgahṛdaya* : *Sūtra* 12 : 4.

4. (a) प्राणोऽनं मूर्खः…… । *Aṣṭāṅgahṛdaya* : *Sūtra* 12 : 4.

(b) स्थानं प्राणस्य मूर्खोः…… । *Caraka* : *Cikitsa* 28 : 6.

*rasa* viz. the carbohydrates. On the other hand, the insoluble proteins are digested, predominantly by the *amla* type of *srāva*, that occurs here, rendering this substance viz., proteins, soluble. At this stage, the food substances remain partly digested and partly undigested i.e., their digestion is still incomplete. This aspect was described earlier at page 38. It would appear that the *amlabhāva* of the *avasthāpāka*, is further continued under the influence of *jātharāgni*, resulting in the final breakdown—*bhinnasamīghāta*—of various constituents of the food, which are meant to be absorbed from the *āmāśaya* into the system. Caraka says "The food that has reached *āmāśaya* or the seat of digestion, being fully digested, is distributed in its changed form to the entire body by means of *dhamanis*.<sup>1</sup> The term '*dhamani*' in this context obviously refers to blood vessels and lymphatics in the villi of the small intestine, through which the absorbed food is transported to the liver and cysterna chyle respectively, from whence, it is distributed to all the parts of the body through the circulating channels for providing nourishment to tissues.

*Samāna Vāyu*—A reference to *samāna vāyu* is necessary here, as this *vāyu* is stated to reside in and exercise control over intestinal digestion. According to Vāgbhaṭa, *samāna vāyu* is present near *agni* and it always moves throughout the *koṣṭha*. In addition, it is stated to enable the reception, digestion, separation and propulsion of food.<sup>2</sup> Functions similar to those of *samāna vāyu* are seen to be performed, for the most part, by the intrinsic nerves of the stomach and intestine. It has been shown by modern researches that numerous nerves are found in the walls of the stomach, intestine and oesophagus. Some of them have been shown to be the terminal fibres of the extrinsic nerves of these organs. These connect the gastro-intestinal tract anatomically and functionally with the brain and spinal cord. In addition to

1. आमाशयगतः पाकमाहारः प्राप्य केवलम् ।

पञ्चः सर्वाशयं पश्चाद्मनीषिभिः प्रपश्यते ॥ *Caraka : Vimāna 2 : 24.* ॥

2. समानोऽग्निसमीपस्थः कोष्ठे चरति सर्वतः ।

अनन्तं गृह्णाति पचति विवेचयति सुश्रुतिः ॥ *Aṣṭāṅgahṛdaya : Sūtra 12 : 8.*

the above, it has been shown that these organs also have complete neurones especially beneath the mucosa and between the circular and longitudinal muscular layers. These neurones are shown to possess short dendrites and axons contained almost entirely within the walls of the tract. They make up a diffuse mesh-work of nerve tissue and serve as a kind of decentralised or "peripheral brain" by which the intestinal movements are controlled independent of the spinal cord and brain. These findings are based on experiments involving the severance of all the extrinsic neural connections of the stomach and intestines which slowed the digestive movements—peristalsis—though modified to some extent, still continue. In other words, as shown by Bayliss and Starling,<sup>1</sup> the section of the sympathetic and parasympathetic does not abolish the peristaltic movements but the application of cocaine to the lower wall results in the abolition of the intestinal movements. Thus, while enteric plexuses function in maintaining the rhythmic peristaltic movement along the digestive tract, the central nerves viz., the parasympathetic and sympathetic exert a regulating effect on gastro-intestinal peristalsis which is of utmost importance to the process of digestion, in the same way as the description of the influence exerted by *samāna* on the process of digestion, as described by *Āyurveda*.

Peristaltic waves mechanically break-up intestinal contents which are well macerated and thoroughly mixed up with the juice of the pancreas, liver and intestine. Further, as parts of semiliquid mass are brought into contact with the absorbing surfaces of the intestinal wall, absorption of the digested portion of the nutrition takes place. The above description will provide an explanation of the function of *samāna vāyu*<sup>2</sup> viz. *annapacana* or enabling the digestion of food, *annavivecana* or the separation of the nutrient fraction from the fraction, which is still to be digested or if undigested the expulsion or *muñcana* of this fraction to the subsequent segments of the

2. Bayliss & Starling : J. Physiol., 1899, 24, 99; 1901, 26.

1. *Aṣṭāṅgahṛdaya* : *Sutra* 12 : 8.

intestine where by churning movements followed by the peristaltic waves the process of digestion is continued without interruption, until, the finally digested residue is passed down in a semi-solid state into *pakvāśaya*.

The *pāka*, that takes place in the *pacyamānāśaya* and which results in the separation of the *sārabhāga* and its absorption into the body, and the propulsion of the *kitṭabhāga*, into the *pakvāśaya*, for further *pākas* is due to *jāṭharāgni vyāpāra*, and this description would appear to be a generalisation of the action or function of several substances, essentially conforming to the root meaning and definition of the term *pitta* viz., *pacana* and *pariṇamana*. Substances referred to above, would appear to include *acchāpitta*—a total concept—which comprises of several digestive secretions viz., liver-bile, pancreatic juice and intestinal secretions such as, *succus intericus* etc. Details of various constituents of the *jāṭharāgni* the substrate on which they act and the final outcome of the several reactions are furnished in the table at page 66a.

Further digestive events which take place in the *bṛhadantra* or *pakvāśaya*, as it is also known, has been succinctly described

by Caraka in the following terms : "the

3. *Kaṭubhāva* material passed from *āmāśaya*, having reached the *pakvāśaya*, being dried up by heat, is rendered into lumps. During this process, pungent (*kaṭu*) *vāyu* is produced.<sup>1</sup> Commenting on the above, Cakrapāṇi Datta has stated that by "*paripiṇḍita pakvāśya*" is meant the change to the form of lumps, in the process of formation of *mala*. By "*vāyuḥ syāt kaṭubhāvataḥ*" is meant, during the process of formation of lumps, pungent *vāyu* is produced.<sup>2</sup>

These observations find corroboration from modern researches, relating to the mode of formation of faeces, according

1. पकाशयं तु प्राप्तस्य शोष्यमाणस्य वह्निना ।

परिपिण्डितपक्तस्य वायुः स्यात्कुम्भावतः ॥ Caraka : Cikitsa 15 : 11.

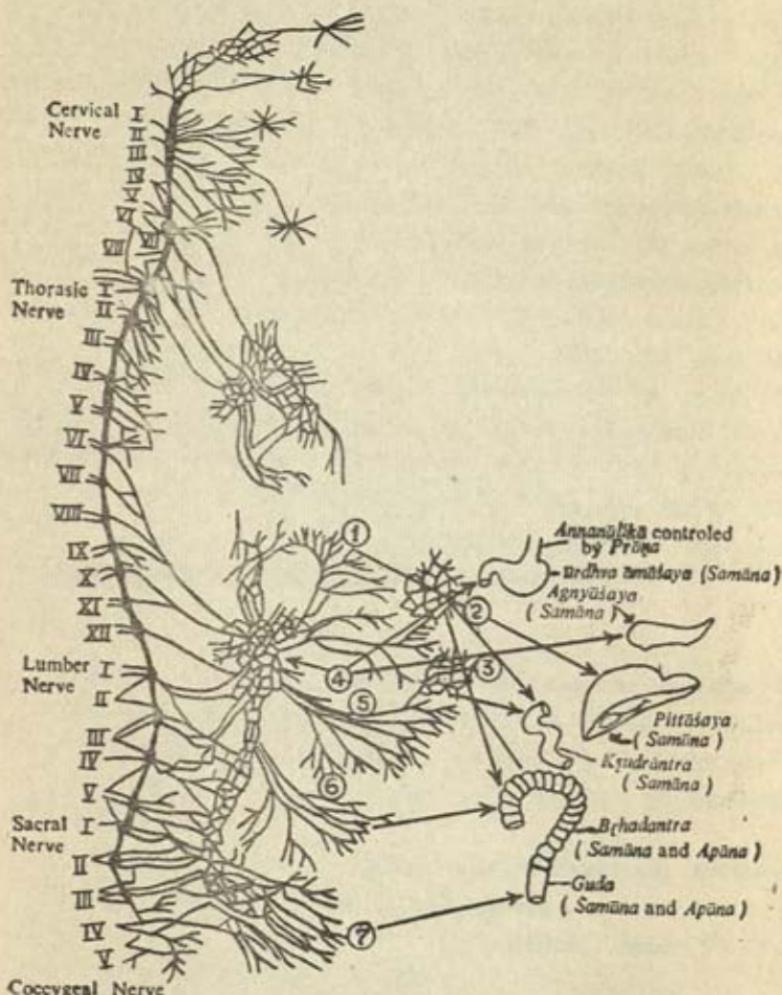
2. परिपिण्डितपक्तस्येति परिपिण्डितरूपतया मलरूपतया पक्तस्य, 'वायुः स्यात्कुम्भावतः' इति परिपिण्डितावस्तोद्भूतकुम्भता वायोरुत्पत्तेते ।

( Cakrapāṇi on above ).

to which during the passage of intestinal contents through the small intestine the products of digestion along with many other compounds such as vitamins and mineral salts, are absorbed. As the contents reach large intestine, the process of absorption with the exception of water is normally completed. In the large intestine more water and salts are absorbed and the remaining material, now converted into faeces, leave the body. The consistency of the faeces depends to a large extent on the degree to which the process of absorption of water has been carried. It is to be noted that the consistency of the faeces also depends upon such factors as gastro-intestinal mobility and the nature of the diet ingested. Slight variation in diet apparently has little or no effect on the nature of the faeces. However, an exclusively vegetable diet, generally yields a larger bulk and softer consistency of faeces while a meat-diet produces harder faeces and less in quantity. The large intestine is the nidus of a large bacterial flora of which *Escherichia coli* is ordinarily the predominant organism. These micro-organisms are shown to be involved in the alteration affecting products derived from the digestion of proteins. They are described as the putrefactive flora which bring about the putrefaction of the protein residues of the food and the liberation in the process of various kinds of pungent gases with disagreeable and often foul odour such as indol, skatol, phenol, hydrogen sulphide and ammonia. Some of these organisms synthesise vitamins of the 'B' group. A part supply of this group is obtained from the intestinal bacteria and a part from outside sources. Thiamin is stated to be produced in unknown quantities by intestinal flora. The importance of B group vitamins to the integrity of the nervous system is now fully recognised.

The foregoing modern contribution are seen, not only to confirm but also amplify the ancient Āyurvedic version of events that take place in the large-intestine and the formation of faeces with the production of pungent *vāyu*. In addition, an explanation of the Āyurvedic view, that *pakvāśaya* is the *sthāna* or seat of *vāyu* also becomes intelligible in view of

## VII

SCHEMA SHOWING VĀTAVYĀPĀRO  
( SYMPATHETIC PORTION ONLY ) OF MAHĀSROTAS

( 1 ) HEPATIC PLEXUS

( 2-3 ) AUERBACH AND MEISSNER'S PLEXUS

( 4 ) COELIAC PLEXUS

( 5 ) SUPERIOR MESENTERIC PLEXUS

( 6 ) INFERIOR MESENTERIC PLEXUS

( 7 ) HYPOGASTRIC PLEXUS

СЛАВУЧАЯ ОДНОЧАСТЬ  
ЗАТОРЖДАЕ ВО ЧЛЮЧИХОДЫХАНИЯХ

the important vitamins required for the wellbeing of the nervous system which are made available from this place.<sup>1</sup>

*Samāna and apāna vyāpāra, and pakvāśaya—*

While *samāna* is stated always to move through the *koṣṭha*<sup>2</sup>—the latter term standing for *mahāsrotas*—*apāna* has been described by Suśruta as having its seat in the *pakvāśaya*<sup>3</sup> and in this place, it is stated to move the *śakṭi* (faeces) downwards. As in the case of intrinsic nerves of the small intestine, the large-intestine also has two intrinsic nerve-plexuses. It is also enervated by both sympathetic and parasympathetic nerves. In otherwords, the proximal part of the colon is enervated by fibres derived from the superior mesenteric plexus, which is partly sympathetic (from the lumbar roots) and partly parasympathetic from the vagus. The distal part of the colon is enervated by sympathetic fibres which reach it from the upper lumbar roots viz. the pelvic splanchnic branches, inferior mesenteric plexus and nerves. The parasympathetic supply to the distal colon is from the 2nd to 4th sacral root by the way of the hypogastric plexus in which are also scattered ganglia to the wall of the colon.

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1. The view that the *pakvāśaya* is the primary *sthāna* or site of *vāyu* of the body, has a bearing on substances which are either available or produced here and which are necessary for the proper functioning of five varieties of *vāyu*, is derived from the following reference :

वायुः पुनरग्नेराहारस्य च वह्न्यपतया तस्मान्मूर्च्छानाविशेषादमूर्त्तः शब्दवानी-  
पच्छम्बद्धप्रचुरोऽल्पो वा पञ्चात्मा वायुः कोष्ठे प्रादुर्भैवति ।

*Aṣṭāṅgasamgraha : Śārīra : 6 : 67.*

2. समानोऽग्निसमीपस्थः कोष्ठे चरति सर्वतः ।  
अग्नं गृह्णति पचति विवेचयति मुच्छति ॥

*Aṣṭāṅgahṛdaya : Sūtra 12 : 8.*

3. पकाधानालयोऽपानः काले कर्त्तति चाप्ययम् ।  
समीरणं शक्तमूर्त्रं शुक्रगर्भार्त्तवान्यवः ॥

*Suśruta : Niśīna 1 : 19.*

The intrinsic plexuses of the large intestine functions in the same manner as those of the small intestine do. As regards the action of the extrinsic nerves, there are different views held by different investigators. Says Lovatt Evans, "It has often been claimed that the sympathetic is inhibitory to the musculature of the colon, with the exception of the ileo-colic sphincter, to which it is motor, while the parasympathetic is motor to all, except the ileo-colic and anal sphincters. But there is doubt about the action of the sympathetic, which is without doubt, often motor, at all events to the circular coat, whether the vagus is motor to the caecum is, also, doubtful."<sup>1</sup>

Movements of large intestine comprise both peristaltic and churning movements. In addition, antiperistalis, especially in the descending colon is stated to enable to slow the movement of the faecal matter downwards overcoming the influence of gravity.

Pressing the explanations furnished earlier as regards *samāna* in the *kṣudrāntra*, it may be said that *bṛhadantra* is also controlled by *samāna* while the predominantly parasympathetic (cranirosacral) innervation will explain the influence of *apāna*.

In a brief review of the secretory activities of the *mahā-srotas* described under the heading *pitta* or *agni* it is necessary to note that the early observations made by Caraka about *madhurabhāva* and *amlabhāva* of the *avasthāpaka*, as well as the influence exerted by the *āhāra*, that has attained *amlabhāva* in the secretion of *accha pitta*, find experimental corroboration from the works of Povolv, Starling, Bayliss, Ivy and others, carried out since late nineties of the last century.

#### JĀTHARĀGNI PĀKA

Even though the *āhārapācana*, discussed above, under *avasthāpaka*, is essentially *jātharāgnipāka*, a further reference

1. Lovatt Evans : Principles of Human Physiology : 11th Edn. page 906.

to this *pāka*, would appear to be necessary, before proceeding to an appraisal of *bhūtāgni* and *dhātavagni pākas*. From the point of view of Āyurveda, all *dravyas* and, in special, *āhāra-dravyas*, which possess six *rasas* viz. *madhura*, *amla*, *lavaṇa*, *kaṭu*, *tikta* and *kaṣṭaya*, when acted upon by *jāṭharāgni*, are stated to yield the following *rasas*, towards the end of *jāṭharāgnipāka* when the formation of *āhāra rasa* is stated to be completed. <sup>1</sup>

Rasa	Caraka <sup>2</sup>	Suśruta <sup>3</sup> quoting others' opinion	Āśtāṅga- Saṃgraha <sup>4</sup>	Āśtāṅga- Hṛdaya <sup>5</sup>	Pārś- vāra <sup>6</sup> quoted in Saṃgraha	Āyurveda Sūtra <sup>7</sup>
Madhura	Madhura	Madhura	Madhura	Madhura	Madhura	—
Amla	Amla	Amla	Amla	Amla	Amla	—
Lavaṇa	Madhura	Lavaṇa	Madhura	Madhura	Madhura	—
Kaṭu	Kaṭu	Kaṭu	Kaṭu	Kaṭu	Kaṭu	Lavaṇa
Tikta	Kaṭu	Tikta	Kaṭu	Kaṭu	Madhura	Madhura
Kaṣṭaya	Kaṭu	Kaṣṭaya	Kaṭu	Kaṭu	Madhura	Amla

( The *pākas* which *āhāra* and *ausadha dravyas* are stated

1. जाठरेणाभिना योगाद्युद्देति रसान्तरम् ।  
रसानां परिणामान्ते स विपाक इति स्मृतः ॥ *Āśtāṅgahṛdaya* : *Sūtra* 9 : 20.
2. कदुतित्तकवायाणी विपाकः प्रायशः कदुः ।  
अम्लोऽम्लं पच्यते स्वादुमधुरं लवणस्तथा ॥

*Caraka* : *Sūtra* 26 : 58.

3. तत्राकुरन्ये प्रतिरसं पाक इति *Suśruta* : *Sūtra* 40 : 10.
4. विपाकस्तु प्रायः स्वादुः स्वादुलवणयोः अम्लोऽम्लस्य कदुतिरेषाम् ।

*Āśtāṅgasamgraha* : *Sūtra* 17.

5. स्वादुः पद्धथ मधुरमम्लोऽम्लं पच्यते रसः ।  
तिक्तोषणकपायाणी विपाकः प्रायशः कदुः ॥ *Āśtāṅgahṛdaya* : *Sūtra* 9 : 21.
6. पाकाख्यो रसानामम्लोऽम्लं पच्यते, कदुः कदुरकम् ।  
चत्वारोऽन्ये मधुरं संकोर्णरसास्तु संकोर्णम् ॥

*Pārśvāra* quoted in *Āśtāṅgasamgraha* : *Sūtra* 17.

7. तिक्तः स्वादुपाके, कपायोऽम्लरसः, ऊषणं लवणः पाके ।

*Āyurveda Sūtra* : *Praśna* 1 : 44-46.

to undergo, under the influence of *jātharāgnipāka* as described by various authorities, are furnished under their names in the tabular statement above).

It will be seen from the table above that there is a difference of opinion between Caraka and Suśruta<sup>1</sup> schools of thought about *vipākas*. According to the former, which have been followed by Vāgbhaṭa in his *Samgraha* and *Hṛdaya*, three *vipākas* viz., *madhura*, *amla* and *kaṭu* are seen to be described; whereas, according to the latter's view, which is followed by Bhadanta Nāgārjuna<sup>2</sup>, there are only two *vipākas* viz., *madhura*, which is *guru* and, *kaṭu*, which is *laghu*. Gaṅgādhara Sena has suggested that Caraka's views on *vipāka* are based on the *rasa* of the *dravya*, whereas, according to Suśruta's school of thought, *vipāka* depends upon the alignment of the *pañcamahābhūtas* in *dravyas*.<sup>3</sup>

It is of interest to note that *Āyurveda Sūtra*,<sup>4</sup> with a commentary by Yogānandanātha said to belong to the sixteenth century has described *vipāka* in a way not contemplated by the *vṛddhatrayī*, viz.,

- ( a ) *svādu* *vipāka* of *tiktarasa* ;
- ( b ) *amla* *vipāka* of *kaṣāyarasa* ; and
- ( c ) *lavaṇa* *vipāka* of *kaṭurasa*.

This work, according to authorities entitled to an opinion is stated to have been compiled on the basis of literature written

1. आगमे हि दिविष एव पाको मधुरः कटुकश्च । तयोर्मधुरालयो गुरुः, कटुकालयो लघुरिति । Suśruta : Sūtra 40 : 10.
2. द्वौ द्वैविष्यदशान्तपरिणामस्य ।
3. इत्यं च रसविष्याकाभिप्रायेण त्रिवापाक उक्तः । सुख्ते भृत्युपाकाभिप्रायेण द्विवापाकः उक्तः । Rasavaśiṣṭika : Sūtra 50.
4. *Āyurvedasūtra* with commentary by Yogānandanātha, Edited by Dr. R. Shama Sastry, Printed at Mysore Govt. Branch Press, 1922. Gaṅgādhara on Caraka : Sūtra 26 : 58.

between first century B. C. and fifteenth century A. D. Though relatively recent, *Āyurvedasūtra* belongs to the late middle age and would represent a further stage of *Āyurvedic* development. In this sense, the views advanced by this work, mark a distinct advance over previous works and is, therefore, worthy of note.

The concept of *vipaka*, it is obvious, refers to the ultimate outcome of gastro-intestinal digestion, as could be judged from the *rasa* or taste of the final and products of origion, which, latter, is seen to be determined by the nature of their physico-chemical composition, as shown in the table below :

Rasas	Caraka <sup>1</sup>	Suśruta <sup>2</sup>	Aṣṭāṅga- hṛdaya <sup>3</sup>	Aṣṭāṅga- Saṃgraha <sup>4</sup>	Rasa Vaiśeṣika <sup>5</sup>
Madhura	Ap <sup>6</sup>	Ap + Pṛthvi	Ap + Pṛthvi	Ap + Pṛthvi +	Ap + Pṛthvi
Amla	Pṛthvi +	Ap +	Pṛthvi +	Pṛthvi +	Ap +
	Agni	Agni	Agni	Agni	Agni
Lavaṇa	Ap +	Pṛthvi +	Ap +	Ap +	Ap +
	Agni	Agni	Agni	Agni	Agni
Kaṭu	Agni +	Agni +	Agni +	Agni +	Agni +
	Vāyu	Vāyu	Vāyu	Vāyu	Vāyu
Tikta	Vāyu +	Vāyu +	Vāyu +	Vāyu +	Vāyu +
	Ākāśa	Ākāśa	Ākāśa	Ākāśa	Ākāśa
Kaṣāya	Vāyu +	Vāyu +	Vāyu +	Vāyu +	Vāyu +
	Pṛthvi	Pṛthvi	Pṛthvi	Pṛthvi	Pṛthvi

- तेषां पण्ठा रसानां सोमगुणातिरेकान्मधुरो रसः, पृथिव्यग्निगुणभूयिष्ठस्वादम्लः, सलिलाग्निभूयिष्ठस्वादवणः, वायवग्निगुणभूयिष्ठस्वात्कुदकः, वायवाकाशातिरिक्तस्वातिक्तः, पवनपृथिव्यतिरेकाकथायः इति । *Caraka : Sutra 26 : 40.*
- भूम्यमधुरुगुणवाहुस्यादन्मधुरः भूम्यग्निगुणवाहुस्यादम्लः, तोयाग्निगुणवाहुस्यालवणः, वायवग्निगुणवाहुस्यात्कुदकः वायवाकाशगुणवाहुस्यातिक्तः पृथिव्यनिलगुणवाहुस्यात्कुपाय इति । *Suśruta : Sutra 42 : 3.*
- ह्यमाम्भोऽग्निह्यमाम्भुतेजः खवायनिलगोऽग्निरेते ।  
दूयोत्वणैः क्रमादभूतैर्मधुरादिरसोद्भवः ॥ *Aṣṭāṅgahṛdaya : Sutra 10 : 1.*
- Aṣṭāṅgasamgraha : Sutra 18.*
- Rasavaiseṣika : Adhyaya 3 : Sutra 38-43.*
- पृथिवी सोमगुणातिरेकान्मधुरो रसः ।

As pointed out earlier, *jātharāgni pāka* of *āhāra*, which latter is made up of substances possessing six different *rasas*, do not apparently undergo any chemical change. By implication, they undergo physical change only as can be seen from the fact that *dravyas* with *madhura rasa* are stated to undergo *madhura vipāka* i.e., their original *bhautic* composition is not destroyed. It must be noted here that generally glucose and its polymers are absorbed as such from the small intestine. Some portion of the carbohydrate of the diet is also seen to be "broken down to acids such as butyric acid and lactic acid, which give the ideal content a reaction which is acid."<sup>1</sup> Similar is the case with *amladravyas*. In the case of *lavaṇa*, there is, however, a suggestion of some change in the constitution of the compound itself, leading to *madhura vipāka*. This may, possibly, be explained by the fact that, with the dissociation of chlorine ions from sodium chloride in solution, the positive sodium ion is left behind. Moncrieff<sup>2</sup> in his "Chemical Senses" has quoted Kahlenberg as having shown "that the saline taste of sodium chloride is due to  $\text{Cl}^-$  ions. It has been determined by the fact that  $\text{NaCl}$  should be more completely dissociated than sodium acetate and that, the concentration of  $\text{Na}^+$  ions in the sodium chloride solution would be greater than the sodium acetate solution. The taste of a molecule of sodium acetate is changed by the dissociation of acetate. Hence, the saline taste of  $\text{NaCl}$  is attributed to  $\text{Cl}^-$  in the molecule." It will follow from this that the heavier  $\text{Na}^+$  fraction may have a taste of its own and the possibility that it may be sweetish can not be ruled out. *Kaṭu* remains *kaṭu*, while the claim that *kaṣūya* and *tikta* undergo *kaṭu vipāka*, under the influence of *jātharāgni* involving a change in their composition leading *pari passu* to a change in their *rasa* awaits corroboration. The foregoing can be represented as follows on the basis of data furnished by modern physiology and bio-chemistry including pharmacology :

1. Leon Schiff; Pathologic Physiology : p. 278. 1951 Edn.

2. Kahlenberg, Bull, University of Wisconsin, quoted by Moncrieff in his "Chemical Senses" page 136, ( 1951 Edition ).

( A ) <i>Madhura</i> —generally carbohydrate	( a ) <i>Madhura</i> as glucose and its isomers ( b ) <i>Amla</i> as lactic acid and butyric acid.
( B ) <i>Amla</i> —mainly organic acids like lactic, butyric, acetic, citric and tartaric and malic acids.	<i>Amla</i> —lactic, butyric acetic, citric, tartaric acid.
( C ) <i>Lavanya</i> —mainly Sodium Chloride—NaCl	$\text{Na}^+ + \text{Cl}^-$ $\text{Na}^+ \rightarrow \text{Madhura} (?)$
( D ) <i>Katu</i> ( E ) <i>Tikta</i> ( F ) <i>Kaṣāya</i>	That, substances possessing these tastes, undergo a change by which their <i>vipāka</i> is rendered <i>katu</i> should await scientific evidence.

It would now seem that *lavana* *vipāka*, as an additional *vipāka*, may have to be added to the three already furnished by *Vṛddhatrayi*. Theoretically speaking, the principle, "as the molecular weight increases there is a gradual change in the taste of salts from saline to bitter and lower molecules of the homologous series will be sweet and higher members bitter"<sup>1</sup> may have an application to the *tikta dravyas* that are stated to undergo *madhura* *vipāka* by *Āyurveda Sūtra*. The example of saccharine can be cited in support of this view. This substance, in its pure form, is bitter but, when broken down to molecules of smaller size in solution it is seen to be sweet and *vice versa*. The group of substances which possess *tikta rasa* to begin with and attain *madhura* *vipāka*, under the influence of *jātharāgni*, can be expected to have

1. Moncrieff : Chemical Sense : 1951 Edn. p. 147.

been broken down to molecules of lesser weight, thus releasing *madhura rasa*.<sup>1</sup>

The question, if *kaṣaya rasa* can yield *amla rasa*, awaits further study.

*Summing up* : The efficient conduct of *jāṭharāgnipāka* results in the conversion of complex food substances into their 'elemental forms' which are separated from the undigested fraction. The former is taken up for further chemical reactions before they are rendered fit for metabolic reactions.

Substances, which are of immediate interest and which are utilised in large quantities, in diet, relate in the order of importance and quantity, to *madhura*, *amla* and *lavaya* groups. The quantity of substances which possess *katu*, *tikta* and *kaṣaya* in an average Indian diet are relatively insignificant even though in certain parts of India especially in Andhra and Orissa *katu dravyas* are also utilised in respectable quantities as a part of normal diet.

### BHŪTĀGNI PĀKA

Both Caraka and Vāgbhaṭa have made direct references to *bhūtāgnipāka* while, Suśruta has made an indirect mention of it. According to Caraka<sup>2</sup>, the digestion of food by *jāṭharāgni*, results in the breakdown of food into five distinct physico-chemical groups viz., *pārthiva*, *āpya*, *taijasa*, *vāyavya* and *nābhasa* (The classification of dravyas under fivefold *bhūta* group is based upon certain physico-chemical properties

1. An example of change from sweet to bitter on ascending homologous series, are the betines of amino acids. Khun *et al* showed that, while velerabetine and caprobetine have transient sweet taste, the betine to amino-penta-dicyclic acid was bitter. Khun & Girol : 3 Physiol : Chemic. 231 : 208-209.
2. मौमाध्यानेयवायव्याः पञ्चोऽमाणः सनाभसाः ।  
चाहारशुणान् स्वान्स्वान्पार्श्वादीन् पचन्ति इति ॥

or qualities ascribed to each *bhūta* class)<sup>1</sup> *Jātharāgni* is stated to ignite the *agni* fraction present in each of the five groups. This *agni* moiety is then said to digest the substance of that group (leading to a radical change in its qualities—*vilakṣaṇa guna*<sup>2</sup>), which renders food substances fit for being assimilated into and built up as parts of corresponding *bhūta* class of substances present in the *dhātus* after the same has been subjected to the action of *dhātvagnis*.

According to Suśruta “the animated human organism is composed of five *mahābhūtas* and the food of a living organic being, necessarily partakes the qualities of its corporeal components. The food which consists of five *mahābhūtas* is digested in its turn by the five *bhūtagnis* and each of its principle proceed to augment its own homologue in the human organism.”<sup>3</sup>

Events, described in the references cited above obviously occur after the ingested food has been suitably dealt with in *jātharāgni pūka*, leading to the reduction of the basic food stuffs into their elemental forms.<sup>4</sup> The latter are classed on the basis of their physico-chemical properties under five

1. (a) तत्र द्रव्याणि गुरुत्वरक्तिनमन्दस्थिरविशदसान्द्रस्थूलगन्धगुणवहुलानि पार्थिवानि, द्रवस्तिन्यथशीतमन्दसरसान्द्रस्थूलपिण्डिलरसगुणवहुलानि आप्यानि, रस्तीक्षणसूक्ष्मलघुरूक्षविशदरूपगुणवहुलानि आनेयानि, लघुशीतरूक्षस्त्वरविशदसूक्ष्मस्पर्शगुणवहुलानि वायव्यानि”।

*Caraka: Sūtra 26 : 11.*

(b) *Aśtāṅgahṛdaya : Sutra 9 : 6-8.*

(c) *Suśruta : Sutra 41 : 4.*

2. भौमादयः पश्चोध्माणः पार्थिवादिद्रव्यवस्थिता जाठराभिसंघ्रितवला अन्तरीयं द्रव्यं पचन्तः स्वान् स्वान् पार्थिवादोन् पूर्वपार्थिवगन्धत्वाद्विलक्षणान् गुणान् निर्वर्तयन्ति ।

*Cakrapāṇi on Caraka : Cikitsa 15 : 13.*

3. पंचभूतात्मके देहे शाहारः पांचभौतिकः ।  
विपकः पंचधा सम्यग् गुणान्स्वानभिवर्धयेत् ॥

*Suśruta : Sūtra 46 : 526.*

4. जाठरेणाभिना पूर्वकृते संषातमेदे पश्चाद्भूतादयः पंच स्वं द्रव्यं पचन्ति ।

*Cakrapāṇi on Caraka : Cikitsa 15 : 13.*

*bhautic* groups viz., *pārthiva*, *āpya*, *āgneya*, *vāyavya* and *nābhasa*. It would seem that the ultimate products of *jātharāgnipāka* are suitably processed by *bhūtāgnipāka*, which are now fit to be acted upon by the specific *agni* associated with each one of the seven *dhātus*, before they are finally synthesised as a part of the latter.

The foregoing description of *bhūtāgnipāka* resembles the description of auto digestion, comparable to anaerolic reactions. This step would seem to be necessary, as the food consumed are foreign to the body i.e. *vijātiya* and unless they are suitably processed they may not be converted as organism-specific i.e. *sajātiya* substances. This can be illustrated with the example of starches, fats and proteins of the food which by the process of digestion are rendered fit to be re-synthesised as organism specific carbohydrate, fat and proteins. Thus, vegetable starch or cellulose is first broken down to its elemental form i.e. glucose and its polymers towards the end of the intestinal digestion before they are again rebuilt in the body as organism-specific animal starch or glycogen. Likewise, fats derived from plants and animals are broken down during the process of digestion to their elemental forms viz. fatty acids and glycerols before they are rebuilt in the body as organism-specific lipids. The same is the case with proteins—vegetable and animal—also. These are broken down into their elemental forms viz. amino acids before they are synthesised as organism-specific proteins viz., albumen, fibrinogen, most of the globulins and non-essential amino-acids.

It would seem that *bhūtāgnipāka* takes place in the *adha-āmāśaya* itself but speaking factually, it would appear from the available description of this *pāka*, that it resembles in some respects events which take place in the small intestine and, in others in the liver. It was shown elsewhere that *yakṛt* or liver itself is anatomically and functionally related to *koṣṭha*. Hence, it may be possited that the *bhūtāgnipāka*, which is commenced in the *adha-āmāśaya*, is continued and completed in the *yakṛt*.

Āhāra representing *śadrasas* in proper proportion (balanced diet)

↓

I Stage—*Madhura bhāva* (*Urdhva īmāśaya* or stomach in the fundus-starch digestion)  
 II Stage—*Amla bhāva* (*Urdhva īmāśaya* in the body and pylorus of the stomach—protein digestion—formation of peptones and acidified chyme)  
*Pacakāgni* (*Jāṭharāgnī*)—passage of the gastric digest (acidified chyme) to *adha īmāśaya* (*kṣudrāntra*) resulting in the discharge, in this place of *acchāpitta* and its action on chyme.

*Sāra* (representing the ultimate elemental forms of the foods ingested—described on the basis of their physico-chemical qualities)—*vijātīya*

*Kitta*

in *pakvāśaya* where separation of substances meant to be eliminated through *mūtra*, *puriṣa* takes place; *Pindikaraya*; formation of *malarūpa vāyu* with pungent and disagreeable odour and the production of substances required for the five *vāyus*

III Stage—  
*Bhūtagni Paka*

<i>Pārthiva</i>	<i>Āpya</i>	<i>Taijasa</i>	<i>Vayavya</i>	<i>Nābhasa</i>
+	+	+	+	+
<i>Pārthiva</i> agni	<i>Āpya</i> agni	<i>Taijasa</i> agni	<i>Vayavya</i> agni	<i>Nābhasa</i> agni

*Indhātvagni Paka*

*Upādāna* and *annarasa* for utilisation for the production of *Sajātīya*

*Pārthiva*  
Structural constituents of the body  
Proteins etc.

*Āpya*  
Body fluids  
Enzymes; metals and minerals like Fe, Cu, Co, Mg, Mag, Mo, Ca, K, Na, Cl, I etc. & many energy locked substances e.g. phosphorus linked sugars, vitamins (coenzymes), some hormones like thyroxin.

*Āgneya*  
Enzymes; metals and minerals like Fe, Cu, Co, Mg, Mag, Mo, Ca, K, Na, Cl, I etc. & many energy locked substances e.g. phosphorus linked sugars, vitamins (coenzymes), some hormones like thyroxin.

*Vayavya*  
constituents required for the synthesis of neural structures and certain hormones like acetyl choline and sympathin etc.

*Nābhasa*  
?

The foregoing description of *bhūtagnipūka* is based on *Carakasamhitā*. Vāgbhaṭa in his *Samgraha*<sup>1</sup> and *Hṛdaya*<sup>2</sup> has clearly described the steps leading to *bhūtagnipūka* and in his view, the separation of *sāra* from *kittā*, takes place after the completion of *bhūtagnipūka*.

A careful study of the works of both Caraka and Vāgbhaṭa shows that the formation of *sāra* and the separation of *kittā* occur towards the end of *Avasthāpūka*, *jāṭharāgni* and *bhūtagnipūkas* which by implication would appear to take place in the terminal portions of the ileum. But available experimental evidences and observations show that as digestion of different compounds of food viz., proteins, fats and carbohydrates are completed, absorption of the digested fraction takes place almost immediately, the undigested portion being taken over for further reactions as it passes down. It would, therefore, seem that the process of digestion and absorption follow each other very closely throughout the entire length of *kṣudrāntra* and, by the time, the food reaches the cecum, hardly any digestable component of it is left. The portion that passes through the cecum represents, for the most part undigested cellulose. If these observations are to be extended and applied to the *jāṭharāgni* and *bhūtagni pākas* then *jāṭharāgnipūka* of the *āhāradravyas*, should be immediately followed by *bhūtagni pūka*, resulting in the separation of *sāra* and its absorption immediately the *kittā* being moved further

1. तत्त्वैव विकृत आहारे पंच पंचात्मका महाभूताभ्यो वायुना व्यस्तान् यथास्व पश्चेव भूतगुणानाहारस्थान् पचनित् । ते पक्वाः पुनर्यथास्वमेव देहाभिराश्च स्वविकारभूतान् भूतगुणानाप्यायवन्ति ।

एवं च पक्वादाहारादिविधौ पक्वगर्भादिव स्नेहादच्छः सारभूतो रसास्यः किट्टास्यक्तं मलोभिनिवर्तते । *Aṣṭāṅgasamgraha* : *Śarīra* 6 : 59-60.

2. भौमाप्यान्नेयवायव्याः पंचोष्माणः सनामसाः । पंचाहारगुणान् स्वान् स्वान् पार्थिवादीन् पचस्यन् ॥ यथास्वं ते च पुण्यनित पक्वाः भूतगुणान् पृथक् । पार्थिवाः पार्थिवानेव शेषाः शेषाश्च देहगान् ॥ किट्टः सारस्य तत्पक्वमन्नं सम्भवति दिष्ठा । तत्रच्छः किट्टमन्नस्य मूर्खं विद्यादधनं शक्तृ ॥

*Aṣṭāṅgahṛdaya* : *Śarīra* 3 : 59-61.

down where the process repeats itself, until hardly anything of *sāra* is left. In this view, the two processes—*jātharāgni* and *bhūtāgni vyāpāras* are concurrent ones.

### ANNAVAHA-SROTĀMSI

A reference to *annavahasrotas* would appear to be necessary at this stage. It may be recalled that, the terms *mahāsrotas*, *koṣṭha*, *āmāśaya*, *pakvāśaya*, *kṣudrāntra*, *bṛhadantra* etc., were used to designate the gastro-intestinal tract with which the *jātharāgni* and *bhūtāgnis* are intimately concerned. The use of the term *annavahasrotas* has also a relevance to the structure mentioned above. This term actually means the *srotas* that conducts *anna* i.e., the conduit or channel through which food is conducted. The term *srotas* at the macroscopic level means a conduit or channel and this term is applicable to varieties of structures such as the tubular system through which blood is conducted—the vascular system; the respiratory passages which conduct air; the lymph channels which conduct lymph, the neural pathways through which nerve impulse flows and the digestive tube through which food passes. All these represent the grosser types of *srotāmsi*. Each one of them, in its turn, is composed of subtle or extremely fine *srotāmsi*, through which various kinds of substances are exchanged from the outside environment with the inside. It may be noted that according to Caraka, all conduits or channels of transport—grosser or subtler—such as *sirā* ( vein ), *dhamanī* ( artery ), *rasāyanī* ( ducts in general and lymphatics in particular ), *rasavāhīnī* ( capillary ), *nādi* ( tubes ), *panthā* ( passage ), *mārga* ( pathway ), *śariracchidra* ( various opening ), *samīyatāsamīryata* ( different kinds of glands some open and others close ), *sthāna* ( location ), *āśaya* ( organ ), *niketa* ( repertory ) are to be deemed as *srotāmsi*;<sup>1</sup> whereas, according to Suśruta "Srotāmsi are channels which have their origin in an organ cavity and spread throughout the body conducting *rasādi*

1. स्रोतांसि, सिराः, धमन्यः, रसायन्यः, रसवाहिन्यः, नाद्यः, पन्थानः, मार्गाः, शरीरच्छिद्राणि संकृतासंकृतानि, स्थानानि, आशयाः, क्षयाः, निकेताश्वेति शरीर-धात्रवकाशानां लक्ष्यालक्ष्याणां नामानि भवन्ति । Caraka : Vimāna 5 : 9.

*dhātus*. These are different from *sirās* ( veins ) and *dhamanīs* ( arteries ) which may otherwise resemble them." <sup>1</sup>

The term *srotas* is self explanatory, that it is defined as *sravāṇāt srotāṁsi*<sup>2</sup>, meaning *srotas* is so called because of *sravāṇa*. *Sravāṇa* means "to exudate" "to transude," "to permeate" or "to filter through." The implications of *srotāṁsi* have been examined by Caraka and they are ( a ) structures through which *sravāṇa* ( oozing, exudation or filtration of fluids ) occurs; ( b ) these are channels through which body fluids are transported from place to place. Another implication, perhaps a significant one of this term as described by Caraka is that *srotāṁsi* are *ayanamukhas*,<sup>3</sup> that is to say, the channels are themselves entrances. This has reference to the function, *srotāṁsi* performs, viz., the transport of nutrients or *prasāda* to and waste products or *malas* from the *dhātus* and *āśayas*. Clarifying the implication of the above, Cakrapāṇi Datta<sup>4</sup> has offered two explanations, viz., ( a ) the term *ayanāni* refers to channels through which something travels and ( b ) *mukhāni* places of entry through which something enters. Therefore, the channels and entrances of *dhātus* and *malas* are not distinct and different entities and the same channel serves both as vehicle for the conduct of *prasāda* and *mala* and they also serve the purpose of the ingress egress of these two substances. As will be discussed at a later stage, the *srotāṁsi* as described above by Caraka and commented upon by Cakrapāṇi Datta would refer to the capillary system which serve twofold purposes viz. *ayanāni* and *ayanamukhāni*.

Extending the foregoing explanations and clarifications to the *annavaha srotas* with which this thesis is concerned this

1. मूलाद खादन्तरं देहे प्रस्तुतस्त्वभिवाहि यत् ।

स्रोतस्त्वदिति विहेयं सिराधमनिवर्जितम् ॥ *Suśruta* : *Sārīra* 9 : 13.

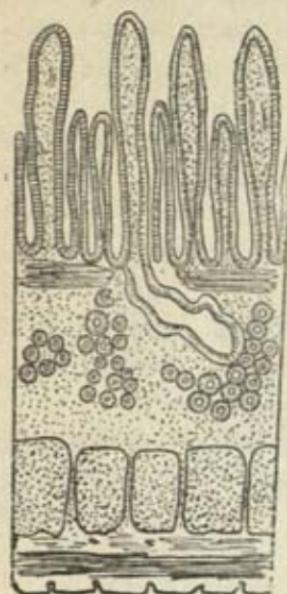
2. धानाद्धमन्यः, खवणात्कोतांसि, सरणात्सिराः । *Caraka* : *Sutra* 30 : 12.

3. तेषां तु खडु मलप्रसादाद्यव्यानां धातूना स्रोतास्त्वयनमुखानि ।

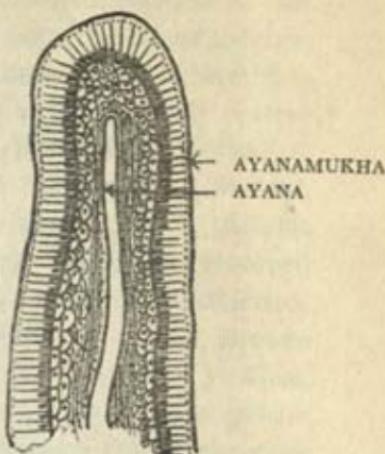
*Caraka* : *Sutra* 28 : 5.

4. अयनानि च तानि मुखानि इति अयनमुखानि । अत्र च आयान्त्यनेन इति

VIII  
ANNAVAHA SROTAS

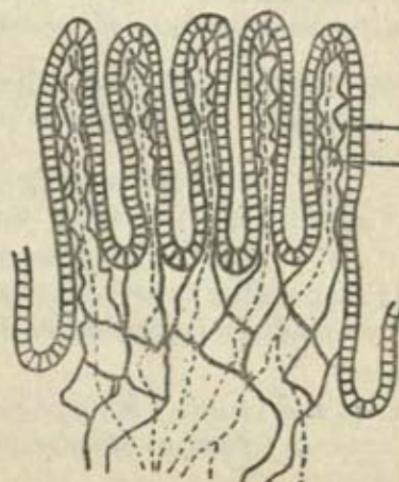


SECTION OF KṢUDRĀNTRA  
( ONE PART OF MAHĀSROTAS )



LONGITUDINAL SECTION OF  
RASĀNKURA (VILLUS)

SECTION OF KṢUDRĀNTRA WITH  
ANNARASAVAHĀ DHAMANI





*srotas* is the long tube commencing from the mouth and ending with the anus through which food is propelled and in which it is digested and also the villi which line the inside of this tube through which the *sāra* or the digested fraction of the food is absorbed and made over to the portal vein and thoracic duct for being transported to appropriate places where they may be dealt with by further *pākas*. Caraka has made a clear reference to the channels through which digested food is absorbed and distributed throughout the body as *dhamani*, present in the *āmūṣaya*.<sup>1</sup> The term *dhamani*, as in the case of *sirā*, refers to blood vessels through which the absorbed food material is transported (regardless of the distinction, made between *dhamani* and *sirā* which, in certain circumstances, are found to pertain to the same structure.<sup>2</sup>) Thus, while the *mahāsrotas* in its grosser aspect represents the gastro-intestinal tract, the intestinal villi represent the subtler units of *srotāṁsi* which compose the former.

#### YAKRT AND ANNAVAHA SROTAS

It may also be mentioned here that *yakṛt* which, as pointed out in page No. 77, represents, in adult life an extension of the *urdhvabhāga* of the *adha āmūṣaya* or *grahāṇi*, is, itself an organ, composed exclusively of *srotāṁsi*. The existing editions of Āyurvedic classics, have recognized this organ as the *mūla* or root of *raktavaha srotāṁsi*<sup>3</sup> and the *sthāna* of *rakta*<sup>4</sup> and *rāṇjaka pitta*.<sup>5</sup> From the point of view of advances made

अयनानि मार्गाणि, मुखानि तु यैः प्रविशन्ति । एतेन मलानां धातूनां च  
यदेवायनं तदेव प्रवेशमुख्यमिति नान्येन प्रवेशो नान्येन गमनभित्युक्तं भवति ।  
Cakrapāṇi on the above.

1. आमाशयगतः पाकमाहारः प्राप्य केवलम् ।  
पक्वः सर्वाशयः पक्वाद्मनोभिः प्रपयते ॥ *Caraka* : *Vimāna* 2 : 18.
2. *Caraka* : *Vimāna* 5 : 9.
3. (a) शोणितवहानां खोतसीं यकृन्मूलं प्लोहा च । *Caraka* : *Vimāna* 5 : 8.  
(b) रक्तवहे द्वे, तयोर्मूलं यकृत्प्लोहानां रक्तवाहिन्यश्च धमन्यः ।  
*Suśruta* : *Śārīra* 9 : 12.
4. शोणितस्य स्वानं यकृत्प्लोहानौ । *Suśruta* : *Śārīra* 21 : 16.
5. यत्तु यकृत्प्लोहोः पित्तं तस्मिन् रजकोऽग्निरिति संशा ।  
*Suśruta* : *Śārīra* 21 : 10.

by modern medical science *yakṛt* is seen not only to be the *sthāna* of *rakta* and *rañjaka pitta*, but also an organ immediately concerned with intermediary metabolism contributing as will be shown at a later stage, to *dhūtvagni vyāpāras*. It is thus seen that "Liver is immediately concerned with carbohydrate, lipid and protein metabolism. In so far as the carbohydrate metabolism is concerned, it converts glucose to glycogen; segments of the carbon skeleton of a portion of the total amino acids metabolised in the body are converted into substances which, in turn, may be employed in glucose and glycogen synthesis—*gluco-neo-genesis*. Fatty acids are re-synthesised, *de novo*, in this organ and released to circulation for being deposited in the adipose tissues. Here also fatty acids of the diet are transformed into a mixture, more closely resembling that of the species. From lipids also the liver re-synthesies cholesterol and esters. In the course of its steroid metabolism the liver elaborates cholic acid and couples it with glycine and taurine to make the bile acids. In addition, the steroids elaborated by various endocrine glands undergo metabolic transformations. As regards protein metabolism, the liver fabricates the non-essential amino acids by employing nitrogen, either from other amino acids or from ammonia. Numerous other nitrogenous materials are synthesised in the liver—ethanolamine, creatine, choline, purines and pyrimidins. Moreover, it is in the liver, that the final steps of the nitrogen metabolism occur, with the formation of urea and uric acid in man. In addition to its activities, in the metabolism of individual amino-acids, liver also fabricates a number of plasma proteins, including albumin, fibrinogen, prothrombin and a major portion of globulins. The cells of this organ contain a significant amount of readily metabolisable protein, in the sense that, upon fasting or an ingestion of protein-free diet, proteins from the liver are rapidly utilised during the period of negative nitrogen balance.

The liver is the site of most of these reactions which involve alteration of foreign compounds which can be mobilised. These reactions include the acetylation of aliphatic and aromatic amines, methylation of mercapturic acid

and hippuric acid, synthesis, oxidation and glucuronide and etherial sulphate formation. Substances, other than glycogen are stored in the liver. These include iron as ferritin and lipid soluble vitamin.

Finally, there is the secretory role of the liver, concerned with the formation of bile. In this role, the liver prepares the bile salts, separates bilirubin from proteins with which it is associated in the plasma, resynthesises cholesterol and pours these with other bile components into the biliary capillaries and thence, via the connecting ducts to the gall bladder. This has also proved to be the route for the excretion of serum phosphatase.”<sup>1</sup>

It will be seen from the foregoing that *yakṛt* or liver has not only inherited some of the functions of *grahaṇī*—the duodenum in particular—but has also, extended the *agni* function of *grahaṇī*, to a high degree of specialisation. If the function of the *grahaṇī*-based *pācakūgni* is of the nature of *vibhāga* or *bhinnasamīghāta* of the *āhāra dravyas*, the *yakṛt* possesses in addition the function of *samyoga* or synthesis. In other words, the *pāka* that takes place in *yakṛt* is both of the *vibhāga* and *samyoga* types. It would, therefore, be necessary to take note of *yakṛt*, in connection with the study of *dhātvagni pāka*. The need for doing so becomes emphasised, in view of the fact that *āhāra rasa*, absorbed from the *adha-āmāśaya*, through the subtler *annavaha srotāni* corresponding to villi has been shown to be transported to the *yakṛt*, through two channels viz., *pratihāriṇisirā* or portal vein, directly and *rasaprapā* or thorasic duct, indirectly, for further *pākas*. If this is not done, the phenomena of *dhātvagni pāka* and subsequent events may remain unexplained.

#### DHĀTVAGNI-PĀKV

By the term *dhātvagni pāka* is meant, chemical reactions to which the *āhāra rasa* absorbed from the *adha-āmāśaya* is subjected to before it is utilised by the *posya* or the *sthāyi*

1. Principles of Bio-chemistry by Abraham White *et al*, pp. 858-59. Mc Graw Hill Publication : 1954 edition.

*dhātus*, present in all parts of the body. The term *dhātvagni* refers to *agnis* or *pittas*, which take part in *pākas*, than occur from *yakṛt* onwards. Seven different kinds of *dhātvagnis* corresponding to seven species of *dhātus* have been envisaged by Āyurveda. They are *rasāgni*, *raktāgni*, *māṁsāgni*, *medogni*, *asthyagni*, *majjāgnī* and *śukrāgni*. These *agnis* are stated to mediate or catalyse metabolic transformations of nutrient substances before they are supplied to the seven species of *dhātus* viz., *rasa* ( plasma, tissue fluid, and lymph ), *rakta* ( the elements of the blood which are red in colour and which float in and circulate with *rasa dhātu* ), *māṁsa* ( muscle tissue ), *medas* ( adipose tissue ), *asthi* ( bone including the cartilage tissue ), *majjā* ( yellow or red bone marrow or the marrow tissue ) and *śukra* ( the male reproductive element ) through their respective specific *srotāṁsi*. Says Caraka "nutrient substances, that support the body, are subjected to *pāka* again, being acted upon by the seven *dhātvagnis*, giving rise to two kinds of substances viz., *kitṭa* and *prasāda*."<sup>1</sup> "Nutritional substances, that nourish the *dhātus*, undergo *pāka* by the *uṣmā* ( *agni* ) of the *dhātus* and then, they are made available to the latter, through this respective *srotāṁsi*."<sup>2</sup>

Earlier, in the chapter on *Vividhāśitapattiya* of the *sūtrasthāna* of his *sāṁhitā*, Caraka has observed that the wholesome foodstuff ingested in fourfold manner, having been digested by *antarāgni*, is followed by further *pākas*, under the influence of *bhūtāgni* which latter have been duly ignited by the former *agni* which again are subjected to further *pākas* by *dhātvagnis*, subject to the condition that the *dhātūśmā* ( *dhātvagni* ), *dhātuvaha srotāṁsi* and *māruta*, are not impaired and *dhātu pāka* is proceeded with as inexorably as *kāla*. *Dhātvāhāras* thus prepared confer upon the organism strength, complexion, happiness, longevity and provide energy to the *dhātus*. The

1. सप्तभिर्द्वैश्चातारो धातवो द्विविद्युनः ।  
यथास्वमनिभिः पाकं यान्ति किञ्चप्रसादवत् ॥ Caraka : Cikitsā 15 : 15.
2. यथास्वेनोन्मय्या पाकं शारोरा यान्ति धातवः ।  
स्त्रोतसा च यथास्वेन धातुः पुष्पति धातुतः ॥ Caraka : Cikitsā 8 : 39.

SHEME SHOWING DIFFERENT STEPS ĀHARADRavyAS UNDERGO TO BE TRANSFORMED INTO DHĀTU  
 ĀHĀRA + JĀTHARĀGNi

( 82 )

Diferent Amśas of Āhāra

Bhūtāgnipāka, in which agni present in each group having been ignited by jātharāgni transforms the vijātīya annarasa into organism specific or sajātīya poṣaka dravyas of dhātus.

These upādāna dravyas combine in different proportions for the formation of dhātus.

Action of Dhātvagnis.

Result of Dhātvagni Pāka :

Prasādabhāga as Poṣya or asthāyi dhātu and Kittabhbāga some portion of which are used up by the body and others eliminated either alone or in combination with anna kittā.

Poṣakadhātu carried by specific srotāṁsi.

Before they are changed to poṣyadhātu, they again, undergo pāka by specific pācakāṁśas.

After pāka, they are changed to sthāyi or poṣya dhātu.

Poṣyadhātu, entering in to the constituent of the body structures.

Prasāda Bhāga

Pārthiva  
+  
Pārthivāgni

Āpya  
+  
Āpyāgni

Taijasa  
+  
Taijasāgni

Vāyavya  
+  
Vāyavyāgni

Nābhasa  
+  
Nābhāsāgni ( Properties of space )

Upādāna  
Rasadhātu  
+

Upādāna  
Raktadhātu  
+

Upādāna  
Māṁsadhātu  
+

Upādāna  
Medodhātu  
+

Upādāna  
Asthidhātu  
+

Upādāna  
Majjādhātu  
+

Upādāna  
Sukradhātu  
+

Rasa Dhātvagni Rakta Dhātvagni Māṁsa Dhātvagni Medo Dhātvagni Asthi Dhātvagni Majjā Dhātvagni Śukra Dhātvagni

Prasāda

Poṣaka  
Rasa  
Dhātu

Kittā

Poṣaka  
Rakta  
Dhātu

Prasāda

Poṣaka  
Māṁsa  
Dhātu

Kittā

Poṣaka  
Medo  
Dhātu

Prasāda

Poṣaka  
Asthi  
Dhātu

Prasāda

Poṣaka  
Majjā  
Dhātu

Prasāda

Poṣaka  
Śukra  
Dhātu

Kittā Bhāga

Mutra

Puriṣa

Vāyu

Dhātumalas  
1 → Mutra  
2 → Puriṣa  
3 Vāyu

4 Ojas (?)

- 5 Tvaksneha
- 6 Viṣneha
- 7 Akṣisneha
- 8 Nakha
- 9 Loma
- 10 Smaśru
- 11 Keśa
- 12 Sveda
- 13 Prajanana mala
- 14 Lomakūpā mala
- 15 Āṣya mala
- 16 Nāśikāmala
- 17 Akṣi mala
- 18 Karṇamala

19 Pitta  
20 Kapha

Through Rasa-  
vahasrotas  
+  
Pācakāṁśa

Sthāyi Rasadhātu  
Plasma, Tissue  
fluid & Lymph

Through Rakta-  
vaha srotas  
+  
Pācakāṁśa  
Rañjaka pitta

Sthāyi Rakta Dhātu  
Elements  
Constituting  
R. B. C.

Through Māṁsa-  
vaha srotas  
+  
Pācakāṁśa

Sthāyi Māṁsa Dhātu  
Peśi, Sirā  
(Muscle) (Vessels)  
Snāyū (Ligaments)  
Kaṇḍarā (Tendons)

Through Medo-  
vahasrotas  
+  
Pācakāṁśa

Sthāyi Medo Dhātu  
Adipose tissue and other  
Lipid containing struct-  
ures like globulins and  
lipoproteins

Through Asthi-  
vaha srotas  
+  
Pācakāṁśa

Sthāyi Asthi Dhātu  
Bones and  
Cartilages

Through Majjā-  
vaha srotas  
+  
Pācakāṁśa

Sthāyi Majjā Dhātu  
Yellow and Red-  
bone marrow

Through Śukra-  
vaha srotas.  
+  
Pācakāṁśa

Sthāyi Śukra Dhātu  
Male & Female  
reproductive  
elements.

Indological Truths

# *Indological Truths*

nutrients, obtained from food sources are the food for *śarīra dhātus* and they contribute to the normalcy of the latter.<sup>1</sup>

Similar references to *dhātvagnipāka* and the order, in which, it occurs are available in *samhitā granthas* and a few more of them, obtained from *Aṣṭāṅgasamgraha* is furnished in the footnote below.<sup>2</sup> The facts that emerge out of these references are—

- (1) The *āhāradravyas*, already suitably dealt with by *jātharāgni* and *bhūtāgni pākas*, are taken up for *dhātvagni pūka*.
- (2) *Dhātvagni pāka* has two aspects viz., (a) *Kiṭṭa pāka*; (b) *Prasāda pāka*.<sup>3</sup>
- (3) The final products arising out of *prasāda pāka* are then transformed to the *śarīra-dhātus* through their respective *srotāṁsi*.<sup>4</sup>

The seven kinds of *dhātvagnis* obviously refer to substances which like enzymes catalyse the synthesis of seven kinds of nutrient substances, required for the use of the seven species of *dhātus*—each *agni*, aiding the conversion of nutrient substances into what may permissibly be called “precursor substances” of the formed *dhātus*, already present in the body. This view is based upon references to *poṣaka* or *asthāyi dhātus* and *poṣya* or *sthāyi dhātus*, found mentioned in Cakrapāṇi's commentary on *Carakasamhitā*.<sup>5</sup> Thus, the *rasāgni* would

1. विविधमश्चिंतं पीतं लीदं खादितं जन्तोहितम् अन्तरभिन्संधुक्षितवलेन यथास्वेनोभ्यमणा सम्यविष्पद्यमानं कालवद् अनवस्थितसर्वधातुपाकमनुप्रदत्सर्वधातूममारुतस्रोतः केवलं शरीरं बलवर्णस्त्रायुषा योजयति, शरीरधातुनूजयति च । धातवो हि धात्वाहाराः प्रकृतिमनुवर्तन्ते । *Caraka : Sutra 28 : 3.*
2. ताम्यां च सारमलाम्यां तदात्मकानामेव शरीरगुणानां धात्वास्वानां यथास्वं स्रोतांसि पारम्पर्येण व्यवच्छिन्ना सन्तानमापूर्यन्ते । स्रोतोभ्यश्च यथाविभागं यथावयवमेव धातवः पुष्यन्ति । *Aṣṭāṅgasamgraha : Śarīra 6 : 61-62.*
3. प्रसादकिण्ठौ धातूनां पाकादेव दिव्याच्छ्रुतः । *Aṣṭāṅgahṛdaya : Śarīra : 3 : 64.*
4. यथास्वेनोभ्यमणा पाकं शारीरा यान्ति धातवः । स्रोतसा च यथा स्वेन यातुः पुष्यति धातुतः ॥ *Caraka : Cikitsā 8 : 39.*
5. यतो दिविधो रसः—स्थायी पोषकधेति, तत्र धातुपोषकपोष्यरसाशयोभेदं विवक्ष्या भेद उक्तः, इह स्थायिपोषकरसाशयेकतया निर्दिष्टौ, स्थायिरस-पोषकरसभागयोः स्थानमेदाधभावादेकत्वम्; एवं कृत्वा सप्तधातुकं शरीरमुच्यते । *Cakrapāṇi on Caraka Cikitsā 15 : 16.*

catalyse the conversion of appropriate substances and their incorporation into the *rasādi dhātus* which latter serves as the vehicle of transport of the remaining *poṣaka* or *asthāyi dhātus*. Similarly, catalysed materials obtained from *zhāra-rasa* are made available to corresponding *sthāyi* or *poṣya dhātus*.

It is obvious that the term *dhātvagni* is a collective noun standing both for group specific and reaction specific enzymes. Even so, metabolic reactions envisaged above are not exclusively anabolic but this also comprise catabolic reactions, which yield waste products or *kittā* in the process. This view is implicit in the *kittāpāka* referred to by Cakrapāni Datta.<sup>1</sup> The outcome of *kittā pāka*, are discharged from the body at periodical intervals and the remaining parts are utilised for the production of a number of structures of the body, such as hair, nail etc.

*Prasāda Pāka*—The available description of this *pāka* in *samhitā granthas*, is reminiscent of synthetic reactions, which form part of the intermediary metabolism—the latter term being described as “all changes which may take place between the moment of entry and the moment of discharge of ultimate chemical products into the environment”;<sup>2</sup> or in the alternative specific chemical reactions which occur within the organism—the other aspect being what is known as energy metabolism which deals with the overall energy production. In general, the process of new tissue formation and the maintenance of the structures already formed constitute tissue building or synthesis. In general, it represents the union of smaller into larger molecules. The reverse process of tissue break down is obviously, concerned primarily with the splitting of the larger protoplasm into smaller ones. The two aspects, the anabolic and catabolic, respectively constitute

1. भूताग्निन्द्यापारं दर्शयित्वा धात्वग्निन्द्यापारं दर्शयन्नाह सप्तभिरित्यादि । देह-  
चातारः इति विशेषेण देहधारकाः । द्विविधमिति द्विप्रकारं पाकम् । तदेव  
पाकद्वयमाह—किंडुप्रसाद इति ; किंडुप्रसादरूपमित्यर्थः ।

Cakrapāni on *Caraka* : *Cikitsā* 15 : 15.

2. Gould : Medical Dictionary.

metabolism as a whole. As stated above, *prasāda pāka*, obviously relates to anabolic aspect and the *kitṭa pāka*—the catabolic.

Thus, *dhāradravyas*, subjected to *dhātvagni pāka* synthesise from out of the nutrient substances, constituents required for the synthesis of each *sthāyi (poṣya)* or formed *dhātu*—the former known as *asthāyi (poṣaka)* or precursor *dhātu*. The *dhātvagnipāka* may also be described from the point of view of biochemical reactions as follows: regardless of the nature of the nutrient material, present in the *annarasa*—this may represent *dravyas*, possessing *ṣadrasas*—the *pārthivāṁśa* of *annarasa* being taken up for the synthesis of the *pārthiva bhāvas* of the compound necessary for *sthāyi dhātus*; *āpyabhāvas* likewise, and so on as regards *āgneya*, *vāyaviya* and *nābhasa*. Be this, as it may, the important point that needs mention here is the fact that the products of *bhūtāgnipāka*, which represent the ingredients, required by the several *dhātus* in the body, are catalysed by *rasāgni*, *raktāgni*, *māṁsāgni*, *medogni*, *asthyagni*, *majjāgni* and *śukrāgni*, the resulting products in the *prasāda pāka*, being the *asthāyi rasadhātu*, *raktadhātu*, *māṁsadhātu*, *medodhātu*, *asthīdhātu*, *majjādhātu* and *śukradhātu*. These end-products or precursor *dhātus* are, then, stated to be transported through *rasadhātu* to the *sthāyi dhātus*, through *srotāṁśi*, specific to each *dhātu* where in the presence of *pācakāṁśas*, these *asthāyi dhātus* are synthesised as part of the existing *sthāyi dhātu*.

*Kitṭa Pāka*—The outcome of *dhātvagni vyāpāra* is stated to yield, among others, the following waste products—

*sveda* ( sweat ), *mūṭra* ( urine ), *puriṣa* ( faeces ), *vāta* ( gases like  $\text{CO}_2$ , indol, skatol, ammonia, hydrogen-sulphide etc. ), *pitta* ( bile pigment ), *śleṣman* ( mucoid excretions ), *karṇa mala* ( waxy excretions from the ear ), *akṣimala* ( mucoid excretions from the eye ), *Nāsikāmala* ( nasal discharge ), *ūsyamala* ( lactic and ascorbic acids, choline, phenols, urea, glucose, thyrocynate, iodides, nitrates, calcium etc.<sup>1</sup> ), *loma-kūpamala* ( excretions discharged through hair follicles—

1. West and Todd : A Text Book of Biochemistry, 2nd Edn. p. 462.

sebum), *prajanana mala* (smegma and vaginal discharges), *keśa* (hairs), *smaśru* (beard), *loma* (hairs all over the body, other than the above) and *nakha* (gelatinous and fibrous tissue, keratin of the nails etc.).<sup>1</sup>

It would appear from the above that waste products arising out of *kiṭṭapāka*, are the precursor elements with which several excretions referred to above are composed. As examples may be cited the cases of *puriṣa*, *mūṭra* and *nakha*.

*Puriṣa*, is seen to represent, not only the undigested food—residue of the intestine, but also, *malas*, which arise from the *kiṭṭapāka* of *dhātus* and which are excreted into the *pakvāśaya* through the *puriṣadharā kāṭa*.<sup>2</sup> These two, together with other substances, present in the *pakvāśaya*, like *sahaja kṛmis*, which inhabit that locality, are thrown out as *śakṛt* or faeces.<sup>3</sup>

It has been shown by modern researches that, "The faeces are composed of food residues, bacteria, materials secreted through the wall of the intestine and bile, leucocytes and disquamated epithelial cells. Food residues constitute a much smaller portion of the bulk of faeces than is usually realised. The fat, protein and carbohydrate of the diet are practically absorbed and if the food be free from indigestible material, especially, cellulose, the faeces are composed almost entirely

1. किट्टात् स्वेदमूत्रपुरोषवातपित्तालेभ्याणः कर्णाद्विनासिकास्यलोमकूपप्रजननमलाः केशमम्बुलोमनसादयश्चावव्यवाः पुष्यन्ति । *Caraka : Sutra* 28 : 4.
2. यकृत्समन्तात् कोष्ठश्च तथान्त्राणि समाप्तिता । उण्डुकस्यं विमन्ते मलं मलधरा कला ॥ *Suśruta : Śārīra* 4 : 16.
3. The water content of the faeces is usually from 60 to 70 per cent by weight. The 20 to 30 per cent dry matter is composed primarily of undigested dietary constituents, such as cellulose material, hair and seeds, fatty material, mineral matter and bacteria. The undigested food protein, carbohydrate and fat amount to very little since the digestion and absorption of these substances is normally 95% to 98% complete. Practically all the nitrogen present is of bacterial origin, (West and Todd : Text Book of Biochemistry, 1955 edition, page 500).

of bacteria and secretions. During starvation, for example, faeces continue to be formed and their composition does not differ materially from that of faeces, passed after an ample diet. Also, a segment of bowel when isolated from the rest of the intestinal tract, becomes, after a time, packed with a mass of pasty faecal material..... Faecal fat is largely endogenous, continuing to appear in the faeces, though all fatty materials have been excluded from the diet; it differs chemically from ordinary food fat, but resembles closely the blood lipids; part of the cholesterol and lecithin is of biliary origin. Calcium, phosphates, magnesium and other inorganic materials in the faeces, are also derived mainly from the blood.”<sup>1</sup>

The foregoing confirm, in part, the Āyurvedic view that some of the products of *kiṭṭapūka* of the *dhātvagni vyāpāra*, are excreted through the *puriṣa-dharā kalā*,<sup>2</sup> into *pakvāśaya*, where together with *annakiṭṭa* and *malarañjaka pitta*, the entire matter now known as *śakṛt*, is eliminated from the body.<sup>3</sup>

The foregoing can be represented as here under :

- ( 1 ) *Āhāra + jaṭharāgni sūra + kiṭṭa* ( *puriṣa* etc. )
- ( 2 ) *Sūra + Dhātvagni prasāda + kiṭṭa* ( *puriṣa* etc. )
- ( 3 ) *puriṣāṁśa* of *dhōtu kiṭṭa* + *puriṣāṁśa* of *annakiṭṭa* = *Śakṛt*.

As regards *mūṭra*, it is seen from modern researches that indol and skatol contribute to the characteristic odour of the faeces. According to Abraham White *et al.*, “indol-acetic-acid, which is excreted in normal urine, could be a result of its

1. Best and Taylor : *Physiological basis of Medical Practice* : 1955 Edn. page 589-90.

2. *Kalās* have been described as structures that define and separate the different basic structural entities—*dhātus*—corresponding to the epithelial lining of various cavities. *Puriṣadharā kalā* extends from *yakṣi*, intestine and other abdominal viscera and serves as a barrier between the faecal matter and chyle. It may, also, be understood as the lining of the large intestine that secretes faeces into this place from the blood.

3. The formation of *annakiṭṭa* ( *puriṣāṁśa* ) separated from *sūrabhāga* of *anna*, under the influence of *jaṭharāgnipūka* has been described in pages 76-77.

formation in and subsequent absorption from large intestine. Indol-acetic-acid is also present in foods of plant origin and this may become another reason of its occurrence in the urine. The second example is tyrosin which in reactions of the large intestine, yields phenol. Reactions of this type probably account for the small amount of phenyl sulphate which may be found in the urine and for the presence of indican (indoxyl-sulphate) as a normal constituent of the urine since these aromatic alcohols are formed in the large intestine from tyrosin and tryptophen respectively absorbed from the gut conjugated with the sulphate in the liver and excreted in the urine.”<sup>1</sup>

The foregoing relate to the intestinal contribution to some of the ingredients to *mūtra*. The remaining ingredients of it such as ammonia, urea, creatinine, uric acid etc., are seen to be derived from the blood and represent the outcome of the metabolic processes.

What has been stated above are seen to support the Ayurvedic view that *dhātavagnipāka* contributes in part substances which are utilised for the composition of *mūtra*. In essence, the nature of *purīṣa* as well as *mūtra* may be taken as an index of *jātharāgni* and *dhātavagnipākas*.

Some of the products of *kitṭa pāka* of *dhātavagni vyāpāra* corresponding obviously to degradation products specially of proteins are seen to be utilised for the synthesis of *keśa* ( hairs ), *smaśru* ( beard ), *loma* ( hairs of the body other than the above two ), and *nakha* ( nail ) etc. This is reminiscent of the modern view that some of the body proteins are degraded and built up as collagen fibres, keratins, hairs and nails etc.

The *prasūda* and *kitṭa pāka*, described above can be illustrated with the example of the formation of *rasa* and *rakta* *dhātus* corresponding to plasma and erythrocytes.

*Rasadhātu*—Substances, essentially protein, in nature (*pārthiṣa* and *āpya* predominantly) in the *annarasa*, corresponding to the amino acids, brought to the *yakṛt*, are synthesised

1. Abraham White et al : Principles of Biochemistry : 1954 edition, pages 515-16.

1. Dravyas required for the synthesis of the constituents.

(A) of rasadhātu, present, among others, in āhāra rasa.

(B) Asthāyi or poṣaka rasadhātu + Pācakāniśa → Poṣya or sthāyi rasadhātu ( Plasma )<sup>2</sup>

2. (A) Dravyas required for the synthesis of the constituents of raktadhātu, present among others in + Raktāgnī → Asthāyi or poṣaka raktadhātu ( Prasāda ) + Pitta<sup>3</sup> ( Kīṭṭa ) sthāyi rasa.

(B) Asthāyi or poṣaka raktadhātu + Pācakāniśa<sup>4</sup> + Rañjakāgnī → Poṣya or sthāyi raktadhātu ( Elements which compose the erythrocyte )

Note:—According to the concept, as now oriented, which is in keeping with the Ayurvedic view that, it is *rasa*, which is circulating throughout the body, having its main seat in the heart or *hṛdaya*<sup>5</sup>—and which, in keeping with the root-meaning of the term *rasa* gatau “अहरहर्गच्छ्रुतीति रसः”<sup>6</sup>—‘rasa’ because it always moves and permeates through different parts of the body and also, the function of *rasa* has been described as the medium that transports *prasāda* to and *malas* from *dhātus*. *Yakṛt* is the place, where this *sthāyi rasadhātu* is formed, for the most part. These *dravyas*, which are present in the āhārarasa or *sāra*, in this view, undergo *dhātvagnipāka* for the most part in the *Yakṛt* and *Poṣakadhātus* formed in the *pāka*, are added to the circulating *rasa*, which make them available to all the tissues in the body, to meet their needs.

3. (A) Dravyas required for the synthesis of the constituents of māṁsadhātu, present among others + Māṁsāgnī → Asthāyi or poṣaka māṁsadhātu ( Prasāda ) + Karṇa, aksi, nāsikā, āsyā, lomakilpa and in sthāyi rasa.

(B) Asthāyi or poṣaka māṁsa dhātu + Pācakāniśa → Poṣya or sthāyi māṁsadhātu ( Enters into the composition of peśi, snāyu, Kanḍara sirā, etc. )

4. (A) Dravyas required for the synthesis of the constituents of medo dhātu, present among others + Medognī → Asthāyi poṣaka medodhātu ( Prasāda ) + Sveda ( Kīṭṭa ) in sthāyi rasa.

(B) Asthāyi or poṣaka medodhātu + Pācakāniśa → Poṣya or sthāyi medodhātu ( Enters into the composition of adipose tissue )

5. (A) Dravyas required for the synthesis of the constituents of asthi dhātu, present, among others in + Asthyagnī → Asthāyi or poṣaka asthidhātu ( Prasāda ) + Keśa, smaśru, loma, nakha ( Kīṭṭa ) sthāyi rasa.

(B) Asthāyi or poṣaka asthidhātu + Pācakāniśa → Poṣya or sthāyi asthi dhātu ( Enters into the composition of bones and cartilages )

6. (A) Dravyas required for the synthesis of the constituents of majjādhātu, present, among others in + Majjāgnī → Asthāyi or poṣaka majjādhātu ( Prasāda ) + aksi, viṭ, tyak sneha ( Kīṭṭa ) the sthāyi rasa.

(B) Asthāyi or poṣaka majjādhātu + Pācakāniśa → Poṣya or sthāyi majjādhātu ( Enters into the composition of yellow and red bone marrow more particularly the latter, forming the elements of one of the raktasthānas in addition to *yakṛt* and *plihā* )

7. (A) Dravyas required for the synthesis of the constituents of śukradhātu present among others in + Śukrāgnī → Asthāyi or poṣaka śukradhātu ( Prasāda ) + Ojas<sup>7</sup>—?—( Kīṭṭa ) sthāyi rasa.

(B) Asthāyi or poṣaka śukradhātu + Pācakāniśa → Poṣya or sthāyi śukradhātu ( Enters into the composition of the male and female (?) reproductive elements )

1. This obviously, refers to intermediary metabolites of protein metabolism which are utilised for the Production of mucus and such other secretions and excretions.

2. Tissue fluid, which is also a part of the concept of *rasadhātu* is derived from plasma and lymph is derived from the tissue fluid, which again, combines with plasma, towards the end of its return journey. Slight variations in composition between plasma on the one hand, tissue fluid and lymph on the other are naturally to be expected.

3. These, obviously, represent waste-products, which arise during the synthesis of the essential constituents of erythrocytes, such as—its pigments, etc.

4. According to this concept, various ingredients, with which the erythrocytes or the elements responsible for conferring red colour to blood, are synthesised by *pācakāniśa* and *raktāgnī* contributed by *āmīṣaya* and *yakṛt*, yield the finished product—the erythrocyte.

5. Caraka : Sūtra 30 : 8.

6. Suśruta : Sūtra 14 : 13.

7. According to *Aṣṭāṅgahṛdaya*, *ojas* is stated to be the *kīṭṭa* of *sukra*, and according to others, it is held to be an *upadhātu* or formed substance which does not undergo any chemical transformation. There are still others who treat *ojas* as the eighth *dhātu*. References :—

A. Aṣṭāṅgahṛdaya : Sūtra 3 : 63 : B. Śrīnigadharā : Pūrvakhaṇḍa 5 : 16 C. Cakrapāṇi on Caraka : Sūtra 3 : 7 D. Āśvaghaṣṭamītī : Sūtra 28 E. Suśruta : Sūtra 15 : 10

# *Indological Truths*

in this organ into characteristic structural constituents of the *sthāyi rasadhātu*; corresponding to plasma proteins,<sup>1</sup> and plasma respectively. These ingredients, plus water obviously replace those which have been already utilised. Thus, the main circulating fluid—*rasa*, serves as the transport medium of nutrients or *poṣakadravyas* (free amino acids, glucose, lipids, minerals, hormones etc.) required for the synthesis of all other *dhātus* in the body and the breakdown products of enzymes or those, which occur during the synthesis of enzymes. These substances must naturally fluctuate more or less widely in concentration depending upon bodily activities and the wear and tear sustained by the *sārīra dhātus*. These are nutritions in transit. Even-so, *rasadhātu* serves as the medium of transport of *malas* or waste products from the *sārīradhātus* and *avayavas* for being disposed of. Our immediate concern is with the constants of the *rasadhātu* itself.

*Rakta dhātu*—*Rasadhātu*, having been formed and replenished, carries in it, ingredients required for the synthesis of the several constituents of the *sthāyi rakta dhātu*, which constantly undergo destruction. Steps involved in the formation of *sthāyi raktadhātu*, can be visualised hereunder :

Firstly, the *poṣaka dravyas*, derived from *āhārarasa* are catalysed by *rasagni* to form the *asthāyi* or *poṣaka rasadhātu* i.e. formed elements, which are meant to be utilised for the synthesis of the *sthāyi raktadhātu*. These basic materials, together with *rañjakāgni* or *rañjaka pitta*, as it is also known, are finally built up as the fully formed *raktadhātu* with *pācakāṁśa*, catalysing the reaction. This can be written as follows—

( 1 ) *Raktapoṣakadravyas* in *rasadhātu* + *raktagni* *poṣaka* or  
*asthāyi raktadhātu*.

( 2 ) *Asthāyi rakta dhātu* + *rañjakāgni* *sthāyi raktadhātu*.  
*Pācakāṁśa*

The orientation of the mode of formation of *raktadhātu* offered above on the basis of textual material available in *samhitā granthas* and some of the important commentaries

1. Albumen, globulin and fibrinogen.

thereon are supported as it were by modern researches on the formation and maturation of erythrocytes.

Beaumont in his wellknown book on medicine observes that, "the primitive marrow cell is converted into a megablast, possibly with the aid of an *unknown agent* ( *italics* mine ). The active principle from the liver and stomach and, *perhaps*, the vitamin B complex helps in the change from megaloblast to normoblast. Iron, copper, thyroxin and possibly vitamin C are concerned with the change from normoblast to erythrocyte." <sup>1</sup>

It will be seen from the above that the maturation of erythrocyte from the stage of megaloblast to normoblast needs substances noted in the foregoing paragraph. These are in the nature of *poṣaka dhātus*—essentially *agneya* in nature. In addition, the active principle from liver and stomach, corresponding to the *rañjakapitta* of Suśruta and Vāgbhaṭa is also seen to be necessary at distinctly different stages of the evolution of the erythrocyte.

Substances referred to in the foregoing paragraph apart, the process of maturation of erythrocyte is also seen to need the aid of an 'unknown agent', mentioned by Beaumont. By implication, this process may not be completed with iron, copper, thyroxin, vitamin C, the stomach and liver factors only and it needs in addition, a factor, the identity of which is not yet known. The author has to suggest, as a hypothesis, that proceeding on the basis of study of the part played by *pācakāṁśas*, in the final stages of the formation of *sthāyi raktadhātu*, the 'unknown agent' referred to by Beaumont, may possibly be some of the cathepsins the analogues of *pācakāṁśas*, present in *sarakta medas* ( red-bone-marrow ). <sup>2</sup>

1. Beaumont : Medicine, 5th Edn. 496 page.

2. Āyurveda has recognized *majja*, present in the hollow of long bones, as one of the *dhātus* ( मेदसस्तानि पूर्यन्ते स्नेहो मज्जा ततः स्मृतः । Caraka : Cikitsā 15 : 32 ). Vaidyaka Śabdasindhu has described *majja* as *śuddha sneha* or pure fat ( मज्जा अस्थनः शुद्धस्नेहमागे…… स्नेहोऽस्थनः शुचिरेव स्थात । ). This *majja* of Āyurveda has not been described as one of the *raktasthānas*. On the other hand

*Metabolic equilibrium*

That the two aspects of *dhātvagnipākas* viz., *prasūda* and *kitta*, under normal states of health, maintain an equilibrium is seen from *Aṣṭāṅgasamgraha*<sup>1</sup> and Cakrapāṇi's commentary on Caraka. Says Cakrapāṇi, "Rasādi dhātus," which are always destroyed are being replaced by *dhātvāhāras*, derived from the four kinds of nutritions, ingested. In his view, the *rasādi dhātus* are lost in catabolic processes and such losses are made good, again, by anabolic events.<sup>2</sup> Says Cakrapāṇi, "Śārīra dhātus, which are destroyed by their own *agnis* are replenished by four kinds of foods ingested."<sup>3</sup>

*Different State of Jāṭharāgni*

All the available editions of the main *Samhitā* *granthas* have described four states of *jāṭharāgni* viz., *sama*, *viṣama*,

Suśruta has designated the *majjā* or marrow present in bones other than long bones as *saraktamedas* (स्थूलस्थिषु विशेषेण मज्जा स्वम्यन्तरस्थिता । अथेतरेषु सर्वेषु सरक्तमेद इष्यते । *Suśruta* : *Śārīra* 4 : 15 ).

Elsewhere, discussing the *sthānas* of *rañjakapitta* he has mentioned that this *pitta*, located in its own *sthāna*, supports the *raktasthānas*, except *yakṣi* or liver and *pūṭha* or spleen, (*Suśruta* : *Sūtra* 21 : 16 ), which are the *sthānas* of *rakta* as well as *rañjakapitta*. It has been suggested that the inclusion of *saraktamedas* as one of the *raktadhātus*, would help in enlarging the theories of the formation of blood from the point of view of *Āyurveda*. In the present context *pneakūṁśa* in *saraktamedas*, is considered to be necessary for the final transformation of the *asthāyi raktadhātu* into *sthāyi raktadhātu*. The former would include all materials produced and processed by *bhūragni* and *dhātvagni pākas*, as may be required, for the synthesis of the *sthāyi raktadhātu*.

1. उत्तरोत्तरानुप्रवेशेऽपि पूर्वेषां स्रोतसां यथाकालं सम्यक् आहारोपयोगेन परिणामवत्तात्प्रायमानानां नापचयो भवति । ततश्च धात्वास्याः प्रसादमलाः स्वं स्वमेव मानमनुवर्त्तन्ते यथावयःशरीरम् । *Aṣṭāṅgasamgraha* : *Śārīra* 6 : 63.
2. धातवो रसादयः, नित्यं क्षीयमाणाः अश्रुतादिज्ञिताः धात्वाहारा एव सन्तः परं स्वास्थ्यमनुवर्त्तन्ते नान्यथेत्यर्थः । Cakrapāṇi on Caraka : *Sūtra* 28 : 3.
3. तेन सर्वेदा स्वान्निषाक्षीयमाणधातोः शरीरस्यादिना उपचयादिवोजनमुपपक्षमिति दर्शयति । Cakrapāṇi on Caraka : *Sūtra* 28 : 3.

*tikṣṇa* and *manda*.<sup>1</sup> This classification of *agni* is seen to have two aspects viz., (a) an aspect, which may be described as natural and which forms part of *prakṛti* or temperament of the individual,<sup>2</sup> and (b) an aspect, in which three *doṣas* become involved, due to the operation of different etiological factors (*ādhyātmika*, *ādhibhautika* and *ādhidaivika*) on the body, leading to a reciprocal influence, between them and *agni*.<sup>3</sup>

(a) *Natural states of agni, as a part of temperamental make-up*—

*Prakṛti* or temperament is inherited and predetermined; that is to say, genetically determined. According to *Āyurveda*, unless described otherwise, *prakṛti* is determined by the state of *tridoṣas* in the parents at the time of fecundation.<sup>4</sup> In this view, the state of *tridoṣas* in the parents at the time of their mating influences the *śukra* or male-reproductive element and *ārtava* or female reproductive element. Accordingly, the *prakṛti* of the child to be born is stated to be influenced and determined.<sup>5</sup>

1. (a) अग्निपु शारीरेषु चतुर्विधो विशेषे वलभेदेन भवति तथा—तीक्ष्णो, मन्दः, समो, विषमधेति । *Caraka* : *Vimāna* 6 : 12.
- (b) प्रागभिहितोऽमिरज्जस्य पाचकः । स चतुर्विधो भवति, दोषानभिपत्र एको, विकियामापत्तिर्विधो भवति । *Suśruta* : *Sutra* 35 : 20.
- (c) समोऽभिर्विषमस्तीक्ष्णो मन्दधेति चतुर्विधः ।  
*Aṣṭāṅgahṛdaya* : *Sārīra* 3 : 74.
2. एते चतुर्विधा भवन्त्यग्रयः—चतुर्विधानामेव पुरुषाणाम् । तत्र समवातपितृ-इलेघ्मणां प्रकृतिस्थानानां समा भवन्त्यग्रयः । वातलानां तु वाताभिभूतेऽन्यविषाने विषमा भवन्त्यग्रयः । पित्तलानां तु पित्ताभिभूते इष्मन्यविषाने तीक्ष्णा भवन्त्यग्रयः । इलेघ्मलानां तु इलेघ्माभिभूतेऽन्यविषाने मन्दा भवन्त्यग्रयः ।  
*Caraka* : *Vimāna* 6 : 12.
3. विषमो वातेन, तीक्ष्णः पित्तेन, मन्दः इलेघ्मणा, चतुर्विधः समः सर्वसाम्यादिति ।  
*Suśruta* : *Sutra* 35 : 20.
4. (a) शुकशोणितसंयोगे यो भवेद् दोष उत्कटः ।  
प्रकृतिर्ज्यवते तेन तस्या मे लक्षणं शृणु ॥ *Suśruta* : *Sārīra* 4 : 58.
- (b) शुकार्चवस्त्वैर्ज्यमादौ विषेणैव विषकिमेः ।  
तैश्च तिसः प्रकृतयो हीनमध्योत्तमाः पृथक् ॥ *Aṣṭāṅgahṛdaya* : *Sutra* 1 : 9.
5. *Caraka* has furnished details as regards factors, which determine or influence, *doṣa*s states in the parents, from the point of view of—

The states of *agni*, according to *prakṛti* are as follows—

<i>Prakṛti</i> or temperament	States of <i>agni</i> <sup>1</sup>	Confer predisposition to <sup>2</sup>
<i>Vāta prakṛti</i>	<i>Viśamāgni</i> (erratic or fitful)	<i>vāta vikāras</i>
<i>Pitta prakṛti</i>	<i>Tikṣṇāgni</i> (acute & sharp)	<i>pitta vikāras</i>
<i>Kapha prakṛti</i>	<i>Mandāgni</i> (Dull & Slow)	<i>kapha vikāras</i>
<i>Sama prakṛti</i>	<i>Samāgni</i> (normal)	resistance to disease.

This classification is of importance in preventive medicine.

(b) According to Vāgbhaṭa, the functioning of *agni* is normal, when *samāna vāyu* is functioning normally, in its own *sthāna*. On the other hand, if this *vāyu* moves to places other than its own, *agni* too will be disturbed; if the same *vāyu* commingles with *pitta* then the *jāṭharāgni* becomes *tikṣṇa* or acute; on the other hand, if it is afflicted by *kapha*, then the *agni* becomes *manda* or dull.<sup>3</sup> In other words, if neural

- (a) *Kāla*—relates to seasonal variations or fluctuations in *deśa* rythm.
- (b) *Garbhāśaya*—The states of *deśas*, which have a bearing on *garbhāśaya*, possibly the *sthānika vāyu*—*apāna*, the *sthānika kapha* of *trika*—*avalambaka* and *sthānika pitta*—( ? ).
- (c) The influence of nutrition and activities—physical and mental—of the mother which may influence the activities of the one or other of the *deśas*.
- (d) *mahābhūta vikāra prakṛti*—physico chemical peculiarities of the *śukra* and *śoṇita* (Caraka : *Vimāna* 8 : 95).

In addition to the above, which have been brought under *pratyūtmaniyata* type of *prakṛti* (vide Caraka : *Indriya* 1 : 5) other factors such as *jāti* (race), *kula* (family), *deśa* (geographical influences), *kāla* (season) and *vayaḥ* (age) etc. play an important role, in the formation of *prakṛti*.

1. तैमेवेदिष्मस्तीष्णो मन्दश्चाग्निः समैः समः ॥ *Aṣṭāṅgahṛdaya* : *Sūtra* 1 : 8.
2. (a) विषमो वातज्वान् रोगान् तीष्णः पित्तनिमित्तज्वान् ।  
करोत्यश्चिस्तदा मन्दो विकारान् कफसम्भवान् ॥

*Sūtrita* : *Sūtra* 35 : 22.

- (b) *Mādhabanidāna* 6 : 2.

- 3 समः समाने स्थानस्ये विषमोऽश्चिस्तिंमान्ये ।  
पित्ताभिमूर्च्छिते तीष्णो मन्दोऽस्मिन्कफपीडिते ॥

*Aṣṭāṅgahṛdaya* : *Sārīra* 3 : 73.

influences on the secretory mechanism of gastro-intestinal glands are normal, then the gastro-intestinal digestive events are also normal or *sama*. On the other hand, if neural influences on the secretory activities of gastro-intestinal glands are hyper-active, then the condition is referred to as *atyagni* or *tikṣṇāgni*. If, on the other hand, there is hypo-secretion of the gastro-intestinal glands due to lack of adequate neural stimuli then the resulting condition is *mandāgni*. Lastly, irregular and erratic secretions—sometimes more and sometimes less—correspond to *viṣamāgni*. The symptomatology of the four states of *agni* are furnished in the table below :

Name of the <i>dosa</i>	State of the <i>agni</i>	Symptoms
<i>Vāta</i>	<i>Viṣamāgni</i>	Sometimes digests slowly, sometimes normally and sometimes produces <i>ādhmāna</i> ( distension of abdomen ), <i>śūla</i> ( colicky pain ), <i>udāvarta atisāra</i> ( diarrhoea ), <i>jathara</i> ( ascitis ), <i>gaurava</i> ( heaviness ), <i>antrakūjana</i> ( gurgling sound in the intestine ), <i>pravāhana</i> ( dysentery ).
<i>Pitta</i>	<i>Tikṣṇāgni</i>	Digests even large quantities of all, too frequent meals; after digestion produces <i>galaśoṣa</i> and <i>dāha</i> ( parched throat ) <i>oṣṭha</i> <i>śoṣa</i> and <i>dāha</i> ( parched lip ) <i>tāluśoṣa</i> and <i>dāha</i> ( parched palate ) and <i>santāpa</i> ( heat and burning sensation ).
<i>Kapha</i>	<i>Mandāgni</i>	Cannot digest, even normal diet properly causing <i>udaragaurava</i> ( heaviness of abdomen ), <i>śirogaurava</i> ( heaviness of the head ) <i>kāsa</i> ( cough ), <i>śvāsa</i> ( dyspnoea ) <i>praseka</i> ( salivation ), <i>chardi</i> ( emesis ), <i>gātrarasadana</i> ( weakness of the body ).
<i>Samadoṣa</i>	<i>Samāgni</i>	Properly digests the normal diet.

This is a state in which the action of *jātharāgni* is considerably inhibited due to the dominant influence of *kapha*, of the three *doṣas*. Hence, this state of *agni* *Mandāgni* is known as *mandāgni*. In this state, the *agni* is unable to digest (and metabolise) even a small quantity of otherwise easily digestible food.<sup>1</sup>

The action of *jātharāgni* in this state is influenced predominantly by *pitta* of the three *doṣas*. The *agni* in this condition is said to be excessively excited *Tikṣṇāgni* and hence it is known as *tikṣṇāgni*. *Tikṣṇāgni* easily digests even a very heavy meal, in a very short space of time. It causes voracious hunger—a condition usually spoken of as *atyagni*—(or *bhasmaka* by certain authorities). It makes possible for a glutton to digest his all too frequent meals. It is stated to produce parched throat, palate and lips, heat or other discomforts.<sup>2</sup>

An erratic state of *agni* arises, as a result of the influence of *vāta*, in the condition described as *viṣamāgni*. In this state, the action of *agni* is irregular and fitful.

*Viṣamāgni* It sometimes helps the process of complete digestion and at other times produces distension of the abdomen, colicky pain, constipation of the bowel, dysentery, ascitis, heaviness of the limbs and loose motions.<sup>3</sup>

1. (a) दुर्बलो विद्वस्यन्नं तद्यात्पूर्वमधोऽपि वा । *Caraka* : *Cikitsā* 15 : 51.  
 (b) यस्तु स्वप्नमप्युपयुक्तमुदरशिरोगौरवकासधासप्रसेकदिंगात्रसदनानि कृत्वा महता कालेन पचति स मन्दः । *Suśruta* : *Sutra* 35 : 21.  
 (c) मन्दस्तु सम्यग्यन्नमुपयुक्तं चिरात्पचेत् ।  
 कृत्वास्य शोषाटोपान्त्रकृजनाभ्यानगौरवम् ॥ *Aṣṭāṅgahṛdaya* : *Śārīra* 3 : 76.
2. (a) तीक्ष्णो मन्देन्वनो धातून् विशोषयति पावकः । *Caraka Cikitsā* 15 : 50.  
 (b) यः प्रभूतमप्युपयुक्तमाशु पचति स तीक्ष्णः । स एवाभिप्रवर्धमानो अत्य-  
 ग्निरित्याभास्यते; स मुहुर्मुहुः प्रभूतमाशुपयुक्तमत्रमाशुतरं पचति; पाकान्ते च  
 गलतात्वोष्टुप्तोषदा इसन्तापान् जनयति । *Suśruta* : *Sutra* 35 : 21.  
 (c) तीक्ष्णो वह्निः पचेत् शीघ्रमसम्यग्निमोजनम् ।  
*Aṣṭāṅgahṛdaya* : *Śārīra* 3 : 75.
3. (a) विषमो धातुवैषम्यं करोति विषमं पचन् । *Caraka* : *Cikitsā* 15 : 50.  
 (b) यः कदाचित् सम्यक् पचति कदाचिदाभ्यानशूलोदावर्त्तिसारजठर-  
 गौरवान्त्रकृजनप्रवाहणानि कृत्वा स विषमः । *Suśruta* : *Sutra* 35 : 21.  
 (c) विषमोऽसम्यग्याशु सम्यग्वाऽपि चिरात्पचेत् ।  
*Aṣṭāṅgahṛdaya* : *Śārīra* 3 : 75.

In the well equilibrated state of functioning of *tridosas*, the *jātharāgni* is, also stated to function normally. This state of its function has been described as *Samāgni*. In other words, *jātharāgni* ensures complete digestion of food ingested at the proper time without any irregularities, when *tridosas* are in an equilibrated state of functioning.<sup>1</sup>

*Influence of different states of jātharāgni upon dhātus.*

Since a co-relation between *jātharāgni* and *dhātus* has been shown to exist in the form of *pācakāṁśas* present in the latter and any departure in the normal state of functioning of the former can logically be expected to influence the latter in many ways. In other words, hypo, hyper and erratic functioning of *jātharāgni* may be followed by hypo, hyper and erratic functioning of *pācakāṁśas*, present in the *dhātus* leading to—

- (a) hypo-metabolism or *mandāgni* leading to states analogous to myxedema, resulting in *dhātuvyādhi*,
- (b) hyper-metabolism or *tikṣṇāgni*, resulting in the digestion of *dhātus* themselves;
- (c) erratic metabolism producing metabolic vagaries.

The implication of the foregoing may be visualised as hereunder :—

*Mandāgni*—Due to deficient digestive secretions in the gastro-intestinal tract much of the nutrition, ingested is wasted and little if any of amino-acids, fatty acids glycerols and glucose as may be formed and absorbed may be inadequate to meet the needs of the tissues. Small quantities of these substances which may be absorbed may not be completely metabolised, due to deficient intermediary metabolism leading to the production of intermediary metabolites; hence, the synthesis of nutrition as well as energy-metabolism may be considerably lowered. In addition, the accumulation of partly

1. (a) युक्तं मुक्तवतो युक्तो धातुसम्यं समं पचन् । *Caraka : Cikitsā* 15 : 51.
- (b) समस्तु खल्वपचारतः विकृतिमापयतेऽनपचारतस्तु प्रकृताववतिष्ठते ।  
*Caraka : Vimāna* 6 : 12.
- (c) तत्र यो यथाकालमुपयुक्तमश्चं सम्यक् पचति स समः समैदोषैः ।  
*Suśruta : Sutra* 35 : 21.
- (d) यः पचेत्सम्यगेवाश्चं मुक्तं सम्यक् समस्तवस्तु ।  
*Aṣṭāṅgahṛdaya : Śārīra* 3 : 74.

metabolised substances in the body may, in their turn, block the metabolic pathways and inhibit or inactivate the enzymes leading to metabolic—hypotoxic—anoxic conditions, thus, conferring susceptibility to varieties of diseases of metabolic origin.

*Tikṣṇāgni*—In the case of *tikṣṇāgni*, the quantity of food material digested and made available to tissues are obviously consumed or burnt leaving hardly any material for the synthesis and maintenance of tissues as in case of thyrotoxicosis.

*Viṣamāgni*—The situation, visualised by this type of disturbances, is difficult to explain.

#### DHĀTUVAHĀ SROTĀṂSI

Elsewhere, *annavaha srotāṁsi* was discussed in page No. 77 in connection with *ahāra pācana* (digestion of food) and its *śoṣana* (absorption). A reference was then made to two aspects of the concept of *srotas* viz. the *sthūla* or macroscopic, corresponding to the *mahāsrotas* or gastro-intestinal tube and the villi, including the capillaries in them respectively. Earlier, while discussing *bhītagni* and *dhātvagni pākas*, a reference was also made to *yakṛt*, as an organ concerned not only with the formation of *rakta* but also with several chemical processes involved in *dhātvagni vyāpāra*. The distribution of the *poṣaka* or *asthāyi dhātus* (precursor homologues) of several *dhātus* of the body was then stated to be transported to the *sthāyi dhātus* through their specific *srotāṁsi*, for their synthesis and maintenance metabolism. Thus, the part played by *dhātuvaha srotāṁsi* and the mode of distribution of *poṣaka dhātus* to the *poṣya dhātus*, as envisaged by Āyurvedic classics and important commentaries thereon assume importance in the context of this thesis.

The importance attached to *srotāṁsi*, in physiological and pathological states, especially, in the description of *samprapti* or pathogenesis of diseases, can be seen from the emphasis laid on the need to understand their structures, by Caraka, Suśruta and Vāgbhaṭa.

Observes Caraka, "malas (waste products) are removed from the *dhātus* and *prasāda* transported to them through the *ayanamukhas* of *srotāṁsi*. These *ayanamukhas* nourish the *dhātu* with appropriate substances to the extent required."<sup>1</sup>

"No structure of the body can flourish or decay independent of *srotāṁsi*. It is undoubtedly the *srotāṁsi* which convey the *dhātus*, which latter undergo transformative changes. *Srotāṁsi* subserve the purpose of transportation."<sup>2</sup>

"Nutrient substances which nourish the *dhātus* undergo *pāka* by *ūṣmā* or *agni* of the *dhātus* and then, they are made available through their respective *srotāṁsi*."<sup>3</sup>

The foregoing citations are a few, among the many, which occur in the *Samhitā granthas*, but those cited above are sufficient to focus attention on the importance of *srotāṁsi*, as the normal healthy state and functions of the body depends upon the integrity of its internal transport system.

Even so, pathological events are also stated to have their origin at the level of *srotāṁsi*, as can be seen from the following quoted from the three main Āyurvedic Classics. Says Caraka, "The *rasadhātu* is continuously circulated throughout the body being propelled by *vyāna vāyu*. Thus, if *rasadhātu* accumulates in any part of the body due to pathological involvement of the *srotāṁsi* (circulatory channels) abnormal changes are initiated. *Dosas* in such a condition become localised and initiate the process of disease in their places."<sup>4</sup> Says Suśruta, "The circulation of *prakupita dosas* is impeded due to the involvement of *srotāṁsi* where, they react with

1. तेषां तु खलु मलप्रसादास्यानां धातूनां स्रोतांस्ययनमुखानि । तानि यथा-  
विभागेन यथास्वं धातूनापूर्यन्ति । Caraka : Sutra 28 : 5.
2. सर्वे हि भावाः पुरुषे नान्तरेण स्रोतांस्यमिनिवृत्तेन्ते, क्षयं वाप्यविगच्छन्ति ।  
स्रोतांसि खलु परिणाममाप्यमानानां धातूनामभिवाहानि भवन्ति अव्यनायेन ।  
Caraka : Vimāna 5 : 3.
3. यथास्वेनोभ्याणा पाकः शारीरा वान्ति धातुवः ।  
स्रोतसा च यथास्वेन धातुः पुष्यति धातुतः ॥ Caraka : Cikitsa 8 : 39.
4. क्षिप्यमाणः ख(स्व)वैगुण्याद्रसः सञ्जति यत्र सः ।  
करोति विकृतिं तत्र ले वर्तमिव तोयदः ॥ Caraka : Cikitsa 15 : 37.

the *dhātus* and *malas* of the locality and give rise to various forms of diseases from that place."<sup>1</sup> Observes Vāgbhaṭa in his *Aṣṭāṅgahṛdaya*, "In all diseases, *prakupita doṣas* reach the site of the disease (*rogādhishṭhāna*) through the *rasāyanīs*<sup>2</sup> and soon cause pathological states."<sup>3</sup>

Thus, a study in some detail of the internal transport system—both macroscopic and microscopic—through which different kinds of substances are transported to and from *dhātus* or tissues becomes necessary. These include gross channels, such as arteries, veins, lymphatics, respiratory passage, alimentary tract, various ducts which open out internally into several cavities of the body and externally through the skin and other structures. We are at the moment concerned with the study of the more subtler or microscopic channels as distribution of nutrient materials to and the clearance of waste products from the *dhātus* or tissues.

*Implication of the term 'Srotāṁsi'—*

Earlier, the definition of *srotāṁsi* offered by Caraka, was referred to in the context of the description of *annavahasrotas*.<sup>4</sup> To recapitulate, the 'srotas' is socalled because of 'sravāṇa' which takes place in it. The term 'sravāṇa' means 'to exude', 'to transude', 'to permeate through' or 'to filter through.' The term itself is derived from the sanskrit root 'स्रु' *srav*णे<sup>5</sup> meaning to exude or to pass through.

The implication of the root-meaning *sravāṇa*, and the definition of *srotāṁsi*, referred to above can be appreciated better by taking into consideration the observations made by Caraka that 'malas' or waste-products are removed from the

1. कुपितानां हि दीपाणां शरीरे परिचावताम् ।  
यत्र संगः स्वैरुण्याद् व्याधिस्त्रोपजायते । *Sufruta : Sutra* 24 : 10.
2. *Rasāyanī* is the synonym of *srotas*.
3. स्रोतांसि, सिराः, घमन्यः, रसायन्यः, रसवाहिन्यः, नाक्षः, पन्थानः, मार्गाः, शरीरच्छिद्राणि संवृतासंवृतानि, स्थानानि, आशयाः, निकेतावेतिशरीरधात्ववकाशानां लक्ष्यालक्ष्याणी नामानि भवन्ति । *Caraka : Vimāna* 5 : 9.
4. Page 77.
5. *Pa. Dhātup.* 965.

*dhātus* and *prasāda* transported to them by *ayanamukhas* of *srotāṁsi*. These *ayanamukhas* nourish the *dhātus* with appropriate substances, to the extent required. In this view, there are two aspects to the concept of *srotāṁsi*, viz., (1) these are structures through which *sravāna* or oozing (exudation or filtration) of fluid takes place; (2) they are channels through which body fluids are transported from place to place.<sup>1</sup>

Describing the state and forms of *srotāṁsi*, Caraka says that these take the colour of the *dhātus* they transport—they are either tubular, large, minute, elongated or reticulated in appearance.<sup>2</sup> All these forms and in special the reticulated form of it have a relevancy to this discussion. Even so, the use of the term *ayanamukhāni*, is significant in the identification and description of the functions of *srotāṁsi*. This term is made up of two words viz. *ayana* and *mukha*. Caraka has described *ayanamukhāni* as channels, which are themselves entrances. Cakrapāṇi, in his interpretation of the term *ayanāni*, has stated that this term means channels through which materials travel and *mukhāni*—openings, through which materials enter or make an exit. Therefore, says Cakrapāṇi “the channels and entrances of *dhātus* are not different entities and the same channel serves both as a conduit for the transmission of *prasāda* and *malas* alike.<sup>3</sup> It also serves the purpose of their ingress and egress. It would, thus, seem that the term *srotāṁsi* refer to channels which serve both as a conduit as well as the medium through which fluids exude, transude, permeate or filter through. This interpretation is supported both by the *nirukti* and *vyutpatti* of the term *ayana mukha*. The term *ayana* is derived from the root “इण गतौ”<sup>4</sup>

1. अयनानि च तानि मुखानि चेत्ययनमुखानि । अत्र आयन्त्यनेन इति अय-  
नानि मार्गाणि, मुखानि तु यैः प्रविशन्ति ।

Cakrapāṇi on Caraka : Sutra 28 : 5.

2. स्वधातु समवर्णानि वृत्तस्थूलान्वयणूनि च ।

स्त्रोतांसि दीर्घाण्याकृत्या प्रतानसदृशानि च ॥ Caraka : Vīmāna 5 : 25.

3. एतेन मलानां चातुर्नां च यदेवायनं तदेव प्रवेशमुखाभिति नान्येन प्रवेशो नान्येन  
गमनभित्युक्तं भवति । Cakrapāṇi on Caraka : Sutra 28 : 5.

4. Pt. Dhātup. 1070.

meaning 'to go' or 'to move', implying "through which something moves." The term 'mukha' is derived from the root 'मुच्छ् मोच्णे' <sup>1</sup> meaning, 'to leave' or 'to be free.' Amarasiṁha has used the term 'च्छवण' as a *paryāya* or synonym of 'niḥsarana' meaning a structure through which things get out or get in. It is in this context Suśruta's description of *srotāṁsi*, with certain reservations, assume importance. He has described *srotāṁsi* as channels, which have their root or origin in an organ cavity (*chidra*—*Dalhaṇa*) and spread throughout the body conducting *rasādī dhātus*. These are different from *sirās* and *dhamanis*, <sup>2</sup> which may otherwise resemble them.

The mention, here, of *rasādī dhātus*, which are stated to circulate through the *srotāṁsi* need an elucidation. By *rasādī dhātus* is meant the *sthāyi rasa* cum *rakta* which circulate and transport the *poṣaka* or *asthāyi dhātus* to other *poṣya* or *sthāyi dhātus*. The fluid that circulates through *dhamanis* and *sirās* which have their origin in the *hrdaya* or heart, is stated to be *rasa*. <sup>3</sup> This fluid is the vehicle which carries nutrients to all the tissues of the body and it is this fluid, again, which exudes, filters and diffuses through the *ayana mukhas* of the *srotas*. A distinction between the circulating *rasa* and *rakta* cannot obviously be drawn as the fluid that circulates in the *dhamanis* and *sirās*, is a composite whole and a complex-flowing tissue composed of the *sthāyi rasa* and *rakta*. It is significant to note here that *Āyurvedasūtra*, a fifteenth century work has advanced the view that "rasa itself is *rakta*, <sup>4</sup> *rakta* is *rasa* <sup>5</sup> and *rakta* is both *rasa* and *rakta*.<sup>6</sup> In addition, pro-

1. Pt. Dhātup. 1455.

2. (a) मूलात् खादन्तरं देहे प्रसूतस्त्वभिवाहि यत् ।

स्रोतस्तदिति विजेयं शिरावमनिवर्जितम् ॥ *Suśruta* : *Śārīra* 9 : 13.

(b) मूलात् खादिति हृदयादिचिछाद्रात् । *Dalhaṇa* on above.

3. ..... सम्यक्परिणतस्य यस्तेजोभूतः सारः परमसूक्ष्मः स रसः इत्युच्यते ।  
तस्य हृदयं स्थानम् । *Suśruta* : *Sūtra* 14 : 2.

4. रसो वासुक् । रसो वै सः । *Āyurvedasūtra* : *Praśna* 2 : page 100.

5. असुगेव रसः । *Ibid* : *Praśna* 8 : page 25.

6. असुगेव रसासृक् । *Ibid*.

ceeding on the basis of *adhikarana siddhānta*,<sup>1</sup> the fluid that is drawn in *raktamokṣaṇa* is red and it is pumped or thrown out as it were by *hrdaya*. This fluid is both *rasa* and *rakta*, in the sense that *raktadhātu* while being transported by *rasadhātu*, during its *vikṣepaṇa* imparts to the latter its characteristic red colour. Cakrapāṇi Datta has also recognized *hrdaya* as the seat of *rakta*.<sup>2</sup>

*Dhamanīs* are also stated to be the medium, through which *ojas* is made available to *dhātus*. They (*daśamahāmūladhamanīs*) emerge from *hrdaya*.<sup>3</sup> *Rasa*<sup>4</sup> and *rakta* are also, *paryāya padas* (synonyms) of *ojas*. It will be relevant to note here that, both Dālhaṇa<sup>5</sup> and Cakrapāṇi,<sup>6</sup> commenting on the term "*Dhātugrahaṇaniḥṣṭam*" in connection with *ojovisraṁsa*, *ojovyāpat* and *ojahkṣaya*, have interpreted this term as *dhātuvaha srotas*. Cakrapāṇi has in addition stated that their *srotānīsi* are also *ojovāhinīs*. It would thus seem that the *daśamahāmūladhamanī*, which emerge from the heart and spread throughout the body giving off ever smaller branches ultimately end as *srotānīsi* which perforce must be extremely subtle tubes with innumerable openings or pores in their walls, through which *rasa sravaṇa* takes place. In this sense, *srotānīsi* would demarcate and line the *dhātus* and answer to the description of *kalās* viz., *dhātvyāśayāntara maryādā*.<sup>7</sup>

The importance of the foregoing conclusions will be

1. तत्र यमधेमधिक्षयोच्यते तदधिकरणम् । *Suśruta* : *Uttaratantra* 65 : 8.

2. रक्तादीनां तु सर्वशरोरचराणामपि विशेषेण हृदयं स्थानमुक्तम् ।

Cakrapāṇi on *Caraka* : *Cikitsā* 24 : 36.

3. तेन मूलेन महता महामूला मता दश ।

ओजोवाहा : शरीरेऽस्मिन् विधम्यन्ते समन्ततः ॥ *Caraka* : *Sutra* 30 : 8.

4. ...रसधौवः संख्यातः... ॥ *Caraka* : *Nidāna* 4 : 7.

5. यातुग्रहणमिति भातवो गृष्णान्ते यैस्तानि यातुग्रहणानि योतांसि, तेभ्यो निःसंत निर्गतः सर्वधातुस्नेहपरम्परारूपेण; अव्यवा यातुग्रहणं हृदयं यातुग्रह-स्रोतसो स्थानस्थात, तस्माद्बहुदयान्निःसृतं स्रोतसो मुखैरेव ।

Dālhaṇa on *Suśruta* : *Sutra* 15 : 23.

6. भातवो गृष्णान्ते यैस्तानि स्रोतांसि ओजोवाहीनि । Cakrapāṇi on the above.

7. कलाः खस्यपि सप्त भवन्ति यात्वाश्चयान्तरमर्यादाः । *Suśruta* : *Śārīra* 4 : 5.

readily appreciated by the fact that Caraka has described the characteristic features of *dhamanis*, *srotāmisi* and *sirās* in the context of the description of the mode of distribution of *ojas* to all parts of the body..... ." They are spoken of as *dhamanis* because they pulsate, as *srotāmisi* because they permit oozing and *sirās* because they maintain continuous flow"<sup>1</sup> obviously of *rasa* and *rakta*.

This passage is significant in the sense that it describes in simple terms different aspects of circulation in which the heart occupies a central position comparable to a pumping station. The order of enumeration of *dhamanis*, *srotas* and *sirās* is also seen to be meaningful and purposive. No doubt there exist morphological and functional differences between *dhamanis*, *srotas* and *sirās*, which, according to Caraka's definition would appear to correspond to arteries, capillaries and veins respectively. The unity and diversity of these three component parts of the circulatory apparatus can be seen from the fact that the heart and the entire vascular system have been shown, to be lined with a single continuous layer of smooth flat epithelial cells. These constitute the entire internal wall of blood and lymph capillaries, but in larger channels muscle and fibrous elastic tissues envelop the lining layer the wider the vessel thicker is the wall. Arteries which bear the burnt of internal fluid pressure are particularly thicker as compared to veins and lymph vessels. Arterial blood flows in rhythmic spurts, in keeping with the rythm of the heart. As each spurt of fluid impinges on the wall of arteries, it gives rise to pulse vibration (*dhmāna*). Likewise as the distance from the heart increases, the arterial spurt becomes less and less powerful. By the time blood, through the capillary vessels, reaches veins, it no longer spurts but flows in continuous even stream. Thus, *hṛdaya*, *dhamanis*, *srotāmisi* and *sirās*—including *rasavaha srotāmisi*—constitute a single circulatory unit, which regulate the proper flow of blood, supply nutrition to and remove waste-products from *dhātus*.

1. अग्नानात् धमन्यः, अवणास्त्रोतांसि, सरणात्सिराः । Caraka : Sutra 30 : 12.

The reason, why Suśruta sought to exclude *sirās* and *dhamanis* from the description of *srotānsi*, will become clear by taking into consideration the fact that endocardium which is made up of a single layer of endothelial cells which as the tunica intima of large arteries like 'Aorta', medium sized arteries like the 'femoral' and small arteries like *dorsalis pedis*, arterioles, etc. finally end as capillaries and continue beyond as the tunica intima of veinules, small veins, medium sized veins and big veins which finally end as the endocardium of the heart. Even so, the lymphatics which commence at the level of the tissues are also lined by endothelial cells and finally end in the heart. *Sravana* does not take place either from a *dhamani*—big, medium or small or from *sirās* (veins) likewise, but it actually occurs at the level of *srotānsi*, which are both *ayanas* and *mukhas*.

The *dhātuvaha srotānsi* can now be compared with the endothelial walls of capillaries with sufficient justification. Capillary walls have been shown to be composed of endothelial cells joined at edges to form a tube. These cells are not similar to other types of cells in that they possess the property of being semi-permeable, that is to say, they exercise selective discrimination in permitting certain materials to enter through them, while denying entry to others. The dimension of the capillary wall is one cell layer thick. They are made up of intercellular pores corresponding to the description of *mukhāni* of *srotānsi*.

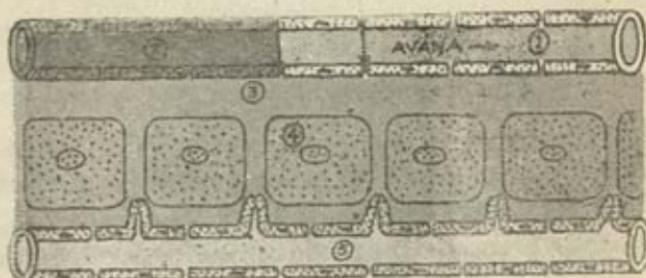
#### *Capillary system and dhātuvaha srotānsi*—

Capillaries, like *srotānsi*, are extensively minute tubes that lie between the arterioles and veinules, the space between the two, being occupied by tissues or *dhātus* and tissue spaces filled with fluid. The diameter of a capillary is less than that of a hair, so that, in many of them red blood corpuscles may have to pass through in a single file. Their diameter varies from 5 to 20 microns and about 0.5 mm. in length.

The function of capillaries is apparently determined by their structure. This is specially important having regard to the two-fold functions ascribed by Āyurveda to *srotānsi* viz.

IX  
DHĀTUVAHĀ SROTAS

AYANAMUKHA



- ( 1 ) ARTERIAL END OF THE CAPILLARY
- ( 2 ) VENOUS END OF THE CAPILLARY
- ( 3 ) TISSUE FLUID ( LASIKĀ )
- ( 4 ) TISSUE CELLS ( DHĀTUPARAMĀṇUS )
- ( 5 ) LYMPH ( LASIKĀ )



*ayana* and *mukha*. As mentioned earlier the capillary walls are composed of merely a single layer of that endothelial cells joined to one another at their edges by a cement substance which is considered to be made up of a mesh of calcium proteinate. Nutrient materials—*poṣaka dravyas*—and oxygen—*vijātiya tejas*—pass out from capillaries to the tissues and carbon-di-oxide—*malarūpa vāyu* and other breakdown products of metabolism—*dhātumalas*—enter the blood-stream and they are carried away.

The space between the capillary wall and tissue-spaces is filled with tissue fluid which filter or oozes through the wall—*sravanya*—through *ayanamukha* of *srotāmsi-capillaries*. This fluid is derived from blood plasma—*sthāyi rasa dhātu*.

A system of lymph vessels drain the fluid from extra cellular spaces and this fluid in lymph vessels (*rasāyanis*) is known as the 'lymph.' There is in fact no difference between the tissue-fluid and lymph. It may be noted that blood passing through tissues is really confined to capillaries and in the normal course of events, it does not come in direct contact with cells i.e. *dhātus*. The lymph or tissue fluid on the other hand is in the tissue spaces outside the capillary wall and it is this fluid that baths tissue cells.<sup>1</sup> Not only this, it acts as a medium of exchange between blood and tissues. *Poṣakadravyas* or nutrient materials pass through capillary wall and are carried by tissue fluid to cells. Even so, waste-products of cell metabolism, i.e. *kiṭṭa* that arise out of *dhātvagni pāka* pass from the tissue or *dhātu* to tissue-fluid which is then absorbed into the blood stream and carried away. The *rasāyanayāḥ* (lymphatic) system represent an one way traffic. Its function is to gather tissue-fluid and not to distribute it. Smaller *rasāyanis* join together to form large ones and in their turn they ultimately drain into veins or *sirūs*. At this point *rasa* or lymph once again becomes part of *rakta* or blood and is distributed by arterial or *dhamani*

1. स रसः इत्युच्यते, तस्य दृढयं स्थानं, स हृदयात् चतुर्विंशतिष्ठमनीरनुप्रविश्योध्वंगा दश दशायोगामिन्यः चतुर्लक्ष्यं तिर्यग्नाः कृत्स्नं शरीरमहरहस्तपैयति, वर्षयति, धारयति, यापयति चादृष्टदेतुकेन कर्मणा । *Susruta* : *Sutra* 14 : 3.

system. Lymphatic capillaries are wider and irregular as compared to the blood capillaries. They anastomose to form elaborate plexuses or become reticulated.

*Specificity of srotāṁsi—*

*Saṁhitā granthas* have correlated *srotāṁsi* with *dhātus* and have described them by the name of *poṣaka dhātu*, they carry and the *sthāyi dhātus* to which they are conducted. Thus, there are references to *rasavaha srotas* and *raktavaha srotas* etc. Earlier in page 91 it was noted that *prasāda* portion of the final precursor products of *prasāda pāka* of *dhātuvagni vyāpāra* are transported through specific *dhātuvaha srotāṁsi* to particular *dhātus* to which the *poṣakadhātus* are meant to be supplied. Thus, the nutrient needs by *māṁsa dhātu* of specific substances is channeled through *māṁsavaha srotas* whereas the specific *srotāṁsi* of *majjā* can transport and supply specific substances required for this *dhātu*. In other words, each *dhātuvaha srotāṁsi* can be said to be able to exercise a selective discrimination and specificity as regards substances, they carry to specific kinds of tissues.<sup>1</sup> This view finds support from modern scientific researches. According to Abraham White *et al.*, "Although consistent with many observed facts Starling's concept of exchange of materials between the arterial and venous branches does not account for the difference of exchange among various tissues. Additional factors are the structure of the membrane which separate capillaries from tissue-spaces, and rapid diffusion along the length of the capillary. Insight into the differences in the nature of the walls of glomerular capillaries and the capillaries of striated muscle has been gained by comparative measurements of the rates of diffusion of water and solutes between the vascular bed and the extracellular spaces of kidney and muscle. In these studies the permeability to water was found to be hundredfold greater for the glomerular capillaries than for those of muscle. These results were most readily accounted

1. न चान्यस्त्रोतसाऽवधातुपुष्टिः संमवति, सर्वपोष्याणां भिन्नदेशस्त्वात्, न शामिक्षेन स्रोतसा भिन्नदेशवृक्षयोः सेवनमस्ति ।

for by assuming the presence in the capillary wall of pores, the number of which per unit area, as well as their shape and dimensions, can be assumed to vary according to the tissues in which the capillaries are found. (Italics mine). Thus, the Starling concept, which assumes the ultra filtration of blood constituents, is modified to include the concept of porous capillary wall, with pore numbers, dimensions and shapes varying in capillaries of diverse tissues and operation of a rapid diffusion process across the capillaries.<sup>1</sup>

Modern trends as regards the specificity of capillaries as represented by the views of Abraham White *et al* extracted above will highlight the old Āyurvedic view that *srotāṁsi* are specific in their nature and function, according as, the nature of the *poṣaka dhātus* they transport and the *dhātus* to which they supply.

The relevancy of a discussion on *srotāṁsi*, arises in view of the Āyurvedic doctrine that *agni-duṣṭi* may involve *dhātus*, resulting in an accumulation in them of *malas* or *doṣas* as they are called. This has been stated to be preceded by *kha-vaigunya* (*sroto-vaigunya*) leading to *srotorodha* and, in consequence, the obstruction to the free flow and circulation of normal *doṣas* and *dhātus* and the retention of *malas* or *doṣas* in the *dhātu* concerned, leading to an inter-action between the *doṣas* and *dhātus* of the locality where, obstruction has taken place. This phenomenon has been described as *doṣa-dūṣya-sammūrchanā*. The site, where *doṣa-dūṣya-sammūrchanā* takes place, has been stated to be the site where the process of disease is initiated corresponding to the *sthāna samiṣraya* phase<sup>2</sup> of *kriyākālas*.

Adverting to the doctrine that moieties of *pācaka* (*pāca-kāṁśa*) permeate the *dhātus* and augment the function of

1. Abraham White *et al* : "Principles of Biochemistry" 1954 edition; page 734.

2. एवं कुपितास्तान् शरीरप्रदेशानागस्य तास्तान् व्याधीन् जनयन्ति । ते यदो-दरसन्निवेशं कुर्वन्ति तदा गुरमविद्युदरामिक्षाना इविसूचिकातिसारं प्रभृतीन् जनयन्ति, वस्तिगताः प्रमेहाश्मरीमूकाशात्मूकदोषप्रभृतीन्, मेदगता निरुद्ध-प्रक्षेपदंशशुकदोषं प्रभृतीन्…… । *Suśruta* : *Sutra* 21 : 37.

*sthānika pitta* must take into consideration the fact that even *srotāṁsi*, that answer to the description of *kalas* which form some of the vitally essential structures of our body corresponding in general to epithelial tissues (endothelium) have metabolic functions to perform in consequence of their vital activities. In cases of *agnimāndya* or the *duṣṭi* of *pācakāgni* it can be logically expected that the *pācakāṁśas* in *srotāṁsi* too may be deficient leading to abnormal functioning of them corresponding to *kha-vaigunya* or functional impairment of *srotāṁsi*. This may be expected to result in the obstruction and occlusion of these vitally important structures resulting in the stasis of *poṣaka dhātus* in circulation and the clearance of *malas* from the related *sthāyi dhātus*. In other words '*srotorodha*' is thus caused. This may be manifested as, described by Caraka, in either an excessive flow (*atipravṛtti*) as in *bahumūtra*<sup>1</sup> or polyuria, resembling *prameha* or diabetes mellitus and insipidus etc. Another example given in the context is *atisāra*<sup>2</sup> or diarrhoea or diminished flow (*saṅga*) as in *mūtrakṛcchra*<sup>3</sup>—anurea—and frequent voiding of faeces in small quantities of the contents of the affected *srotāṁsi* or their dilation (*granthi*) or diversion of the fluid circulating in the affected *srotāṁsi* through different other channels according to the nature of the involvement of the *srotāṁsi* i.e. *srotoduṣṭi*.<sup>4</sup> This would, in effect, mean a heightened permeability resulting in the leakage of materials from *srotāṁsi* or retension of fluid leading to back-pressure and dilatation or the fluid being moved through collaterals to parts other than those to which they supply. Thus, impairment of *agni* may in turn contribute to *srotoduṣṭi* and initiate the process of disease in the site of such occurrence.

1. अतिश्वेन प्रवृत्तिर्था मूत्रवाहिनीोतसा प्रमेहवृद्धमूत्रता ।

Aruṇa Datta on *Aṣṭāṅgahṛdaya* : Śārīra 3 : 45.

2. श्वेदाहीना स्नोतसा अतिसरवत् पुरीषातिसरणमतिप्रवृत्तिः । Ibid.

3. सङ्केऽप्रवृत्तिः । किञ्चिद्वा प्रवृत्तिमूत्रकृच्छ्रवत् । .....सङ्कः स्तोर्क कृत्वा पुरीषस्य प्रवृत्तिः, अथवा सर्वथोदावत्वत् पुरीषस्याप्रवृत्तिः । Ibid.

4. (a) अतिप्रवृत्तिसङ्को चा सिराणा ग्रन्थयोऽपि वा ।

विमानगमनं चापि स्नोतसा दुष्टिलक्षणम् ॥ Caraka : Vimāna 5 : 24.

(b) *Aṣṭāṅgahṛdaya* : Śārīra 3 : 45.

Classical books on *Āyurveda* have treated both *agnimāndya*<sup>1</sup> as well as *srotoduṣṭi*<sup>2</sup> as factors responsible for the causation of diseases. In the view of the author of this thesis the order of occurrence of disease process should include first *agniduṣṭi*, and *srotoduṣṭi* follows as its effect. This has an immediate bearing on *Āyurvedic* therapeutics, as it is seen that *pañcakarma* measures aim primarily at the correction of *agniduṣṭi* before embarking upon treatments meant to remove *srotoduṣṭi*.

### ĀMADOṢA

In the *Āyurvedic* view, nearly all diseases, included under *Kāyacikitsā*, have their origin in *āmadoṣa*. *Āmadoṣa* and *āmaviṣa* are conditions which are stated to occur due to the impairment of *kāyāgni*. It was seen earlier that the *kāyāgni*, in its narrower sense relates to factors concerned with gastro-intestinal digestion and in its wider sense to metabolic events of the body. *Āmadoṣa* or *āmaviṣa*, both as acute and sub-acute or chronic conditions appear to relate to the gastro-intestinal as well as metabolic disturbances engendered due to the impairment of *antarāgni* or better still *agniduṣṭi*. The basic doctrines of *Āyurveda* as regards health and disease revolve round nutrition and its utilisation by the body under the influence of *agni*. Its theories of pathogenesis are also co-related to the type of nutrition available and the functional states of *agni*. Generally speaking, *āma* has been defined as a condition in which the first *dhātu*, namely *rasa* is not properly formed due to the lowered strength of *ūṣmā* (*agni*).<sup>3</sup> On the other hand, in this state, the food

1. (a) रोगाः सर्वेऽपि मन्देऽप्त्वा…… । *Aṣṭāṅgahṛdaya* : *Nidāna* 12 : 1.  
 (b) अभिदोषान्मनुष्याणां रोगसंघाः पृथग्विषाः ।  
 मलवृद्धया प्रवर्तने…… । *Caraka* : *Cikitsā* 13 : 9.
2. (a) क्षिप्यमाणः खैवगुण्याद्रसः सञ्जति यत्र सः ।  
 करोति विकृतिं तत्र…… ॥ *Caraka* : *Cikitsā* 15 : 39.  
 (b) *Suśruta* : *Sutra* 24 : 10.  
 (c) *Aṣṭāṅgahṛdaya* : *Nidāna* 1 : 23.  
 (d) *Ibid* : *Sārira* 3 : 69.
3. कर्मणोऽस्यपवर्त्वेन थातुमादमपाचितम् ।  
 दुष्मामाशयगतं रसमामं प्रचक्षते ॥ *Aṣṭāṅgahṛdaya* : *Sutra* 13 : 25.

ingested becomes *duṣṭa*. According to other authorities, quoted by Vāgbhaṭa, the impaired *vāṭadi dosas* become mixed up with one another, leading to the formation of *āmadoṣa*, very much like the production of *viṣa* from the spoiled *kodrava*.<sup>1</sup> The general outlook of the two descriptions of *āmadoṣa* would appear to be that in the absence of or due to the inhibition of *kāyagni* the ingested food is not properly digested. Products which arise out of such an impaired digestion is retained in the *āmāśaya* and they undergo such changes as yield toxic substances which are known as *āma*. The etiological factors of *āmadoṣa* as described by Caraka and Suśruta, are the following and this range from diatetic indiscretions including errors of nutrition to emotional tensions of different kinds.

#### I. Diatetic indiscretions—

- ( i ) Abstinence from food
- ( ii ) Indigestion
- ( iii ) Over-eating
- ( iv ) Ingestion of
  - ( a ) Unwholesome food
  - ( b ) Heavy or indigestible food
  - ( c ) Cold and stale food
  - ( d ) Excessively dry dehydrated food
  - ( e ) Putrid articles.

#### II. Adverse effects of Therapeutic measures viz.

- ( i ) Purgation
- ( ii ) Emesis
- ( iii ) Oleation

#### III. Emaciation or wasting brought about by other diseases.

#### IV. Incompatibility of the

- ( i ) Country
- ( ii ) Climate
- ( iii ) Season

1. अन्ये दोषेभ्य एवाति दुष्टेभ्योऽन्यमूळात् ।

कोद्रवेभ्यो विषस्येव वदन्त्यामस्य सम्भवम् ॥

## V. Volitional inhibition of natural urges.<sup>1</sup>

## VI. Mental tensions and emotional instabilities like

- ( i ) Envy, impatience
- ( ii ) Fear Complex
- ( iii ) Anger, rage
- ( iv ) Greed
- ( v ) Pessimistic outlook
- ( vi ) Enemity.<sup>2</sup>

The aetiological factors mentioned above apart, note has to be taken of several definitions and descriptions of *āmadoṣa* furnished by Vijayarakṣita in his *Madhukoṣa* commentary on *Madhava Niṭāna*.

(i) "The term *annarasa* means *ama*. If *annarasa* is not properly digested and formed, then the outcome of such a digestion is known as *ama*."<sup>3</sup>

(ii) "In the view of some, due to the impairment of *kāyāgni*, the *annarasa* is not properly formed in the *āmaśaya* and in this state, it is known as *āma*." \*

(iii) "There are others who hold that the undigested *annarasa* possessing foul odour and excessive pastiness deprives

- अभोजनाद्योर्जातिभोजनाद्विमाशनात् ।  
असास्मयशुश्रीतातिरूपसंदुष्मोजनात् ॥  
विरेकवमनस्तेनाद्विभ्रमाद्यापिकर्षणात् ।  
देशकालतुर्वैवस्माद्वेगानां च विधारणात् ।  
दुष्प्रस्थयन्तिः………॥ *Caraka : Cikitsa 15 : 42-43.*
- (a) दैर्घ्याभ्यक्तोधपरिक्षेतेन लुक्षेन रुग्दैन्यनिपीडितेन ।  
प्रदेशयुक्तेन च सेव्यमानमनन्तं न सम्यक् परिपाकमेति ॥  
*Susruta : Sutra 46 : 535.*
- (b) कामकोषलोभमोहेर्याहीशोकमानोदेगभयोपतसमनसा वा यदन्नपानमुप-  
युज्यते, तदप्यामेव प्रदूषयति । *Caraka : Vimana 2 : 8.*
- सोऽप्त्वा रस इति आमः, अक्षरसस्थैवापकस्य तन्नान्तरे आमस्यपदेशात् ।  
*Madhukosa on Madhavanidana 25 : 5.*
- आमाशयस्थकायानेदौर्बेल्यादविपाचितः ।  
आद आदारथात्यः स आम इति कीर्तिः ॥ *Ibid.*

ves the body of its nutrition and in consequence causes *sadana*. This is known as *āma*.”<sup>1</sup>

(iv) Some hold the view that if due to the poor strength of *jātharāgni* a residue of *āhāra rasa* is still left behind undigested towards the end of digestion; it is then known as *āma*, which is the root cause of all diseases.”<sup>2</sup>

(v) “The view that the food which is not properly digested is *āma*, is held by some. Yet, others describe the accumulation of *malas* in the body as *āma*.”<sup>3</sup>

(vi) “There is also the view that the first stage or phase of *doṣa-duṣṭi* is *āma*.”<sup>4</sup>

The mention made by Caraka of the *śuktatva*<sup>5</sup> which the food is stated to undergo and its behaviour as *viṣam* studied together with the mention of *daurgandhya* and *bahu picchilatva*, made by Vijayarakṣita in his reference to other views held on the subject as also the mention made by Vāgbhaṭa to *āmaviṣa* as a serious toxic condition comparable only to acute stages of poisoning which exhibits a symptomatology comparable to *viṣa* may endanger life and therefore, to be treated fatal prognosis<sup>6</sup> need an appraisal.

#### *Implication of the term 'śuktatva'—*

The term *śuktatva* refers to sourness. *Śuktapāka* means a chemical reaction that results in the productions of acids (tasting sour). It will be recalled that the term *amlapāka* was used by Caraka while describing the second *avasthāpāka*. This reference would imply the outcome of normal digestive reactions that occurs in the stomach in which certain

1. अपरे त्वाहुः—अविषक्तमसंबुक्तं दुर्गन्धं वदुपिच्छिलम् ।

सदनं सर्वं गात्राणामाम इत्यभिधीयते ॥

Madhukaśa in Mādhyava-nidśīna : 25 : 5.

2. अन्ये त्वाहुः—आहारस्य रसः शेषो योनपाकोऽग्निलाभवात् ।

स मूलं सर्वं गात्राणामाम इत्यभिधीयते ॥ Ibid.

3. आममज्जरसं केचिद् केचित्तु मलसंचयम् । Ibid.

4. प्रथमो दोषदुष्टिं च केचिद्दामं प्रचक्षते ॥ Ibid.

5. Caraka : Cikitsā 14 : 44.

6. आमदोपं महाषोरं वज्रेयेदिष्यसंशकम् ।

विषरूपाशुकारित्वादिरुदोपकमत्वतः ॥ Asṭāṅgahṛdaya : Sūtra 8 : 14.

components of food are acted upon by *dravyas* present in this place which are *amla* and therefore *āgneya*<sup>1</sup> in nature. It should be noted that even though *śuktapāka* yields substances which are also *amla*, or sour, this term has not been used in the context of normal gastric digestion. The obvious inference to be drawn from this is that the latter term relates to the outcome of abnormal digestive reactions which yield substances having sour taste.

It was pointed out while discussing *avasthāpāka* that certain components of food assume *madhura pāka* and certain others *amlapāka* during the stage of *prapāka* or *prathama pāka*. These were then shown to be starch and proteins. In the case of *śuktapāka* starches undergo fermentative change yielding vinegar-like substances with the difference that the fermentation of sugars in the stomach or intestine under the influence of bacterial enzymes yield various bi-products of fermentation of carbohydrate viz. butyric acid, acetic acid etc. *Āmadoṣa* in which food attain *śuktatva* obviously relate to the fermentation of sugars brought about by bacterial agents which latter have become active due to the loss of *agni* balance. These products are toxic.

#### *Daurgandhya and Bahupicchilatva*—

Even so, the decomposition of such organic substances as proteins under the influence of micro-organisms is accompanied by the development of disagreeable odours and products produced, in this process include gases such as ammonia, hydrogen sulphide, methane and others; toxic substances such as indol, sketol, phenol and others, in addition to coda-*verine*<sup>2</sup> and *putrescein* which are toxic products and known as protamines. Likewise the mass of proteins which has

1. शुक्तपाकिनमूयिष्ठत्वाद्दलः । *Caraka : Sutra 26 : 40.*

2. Pentamethylenediamine, a ptomaine formed by the action of the vibrio comma on protein. 'New Gould Medical Dictionary,' p. 189. Tetramethylene diamine, a product of decarboxylation of ornithin and also, found in putrifying flesh, formerly believed to be responsible for food poisoning and referred to as ptomaine. ( *Ibid* ).

been subjected to putrefaction is also very slimy having been degraded in this process.

*Sahaja krmis or intestinal flora—*

This brings us to an enquiry as to what part bacteria contribute to the *nidāna* of *āmadoṣa* or *āmaviṣa*. This issue will be appreciated better by an appreciation, if *Āyurveda* had recognised *krmis* or pathogenic organisms as the cause of disease. It is significant to note that Caraka, while describing twenty kinds of organisms which are pathogenic also made a reference in passing to innumerable *sahaja krmis* or normal organisms which are present in the body.<sup>1</sup> His commentator Cakrapāṇi has described *sahaja krmis* as *avaikārikas*<sup>2</sup> or non-pathogenic. The question will now arise if these *avaikārikā* or *sahaja krmis* are normal inhabitants of the body, what function they perform in the normal course of events? Following on this, two other questions will also arise viz. (a) whether these *krmis* lead a parasitic existence at the expense of their hosts by living on their nutrients or (b) they lead a saprophytic existence drawing their pabulum from the waste products or *malas* of their hosts? Answers to these questions are not found in the available editions of the *samhitāgranthas*. Hence, it is necessary to take advantage of modern developments in the field of microbiology, to secure a better understanding of the role, the *sahaja krmis* play in normal states of health and contributions they make to abnormal states as well.

According to these developments virtually every animal possessing *māhāsrotas* or *kōṣṭha* ( alimentary canal ) harbours billions of intestinal bacteria more specially in the large intestine. They freely draw upon materials which are either not digested or are indigestible by their host. As a result of their activities, these bacteria contribute to faecal decay.

1. इह स्वस्वप्निवेश ! विशतिविधाः कृमयः पूर्वमुहिष्टा नानाविधेन प्रविभागे-  
नान्यत्र सहजेभ्यः । *Caraka : Vimāna 7 : 9.*
2. अन्यत्र सहजेभ्य इस्यनेन शरीरसहजास्त्ववैकारिकाः कृमयो विशतेरप्यविका-  
मवन्तीति दर्शयति । *Cakrapāṇi on above.*

Under conditions of health bacteria cannot thrive in the stomach due largely to a *drava* secreted in the place which possess *āgneya* properties viz., hydrochloric acid. Bacteria, as may enter the body together with food and drinks, are destroyed by the action of this acid. Nonetheless, a few of them which may manage to escape and survive are swept into the intestine and they gradually manage to find an asylum in the *brhadantra* or *pakvāṣaya* where the climate for their survival is more congenial.

It has been shown that *brhadantra* compared to *kṣudrāntra* is protected sufficiently to resist the passage of toxic substances into the blood stream. By implication, the *kṣudrāntra* is relatively less protected to prevent the passage of poisonous substances into the blood stream. In other words, even though highly poisonous substances are formed in the *brhadantra* by the activities of some of these bacteria, the immunity which this portion of the *māhāsrotas* enjoys generally prevents mischief.

It has been shown that the *population* of *sahajakṛmis* that inhabit the *kṣudrāntra* are different from those of *brhadantra*. These organisms known as *bacillus Bifidus*, perform fermentative and not putrefactive action. The climate of the *uṇḍuka* region ( ileo-cecum ) is generally *amla* or acid due to the nature of its contents which is inimical to the growth and activities of proteolytic *kṛmis*. Ordinarily, so long as the supply of carbohydrate material is adequate, the inhabitants of *uṇḍuka* region flourish. Any other bacteria as may make an excursion into the *kṣudrāntra* are thus prevented from getting a foot-hold in this region.

There are, however, certain conditions, especially in infants in whom the immunity of the *kṣudrāntra* is less than that of the adults, a severe type of toximia, presenting the symptoms of *āmātisūra* and characterised by *vamana*, *atisūra*, *ambukṣaya* ( dehydration ), extreme *dinatva* ( prostration ) take place. This condition is stated to be caused by an extension of some of the population of *brhadantra* into the *kṣudrāntra*. By way of treatment of such conditions measures

are directed towards encouraging the normal acid producing organisms to gain the upper hand. Thus, a liberal supply of carbohydrate especially in the form of lactose is made available for this purpose. This form of carbohydrate reaches further down, to the *unduka* region as compared to other forms of carbohydrates before it is absorbed. Another interesting method reminiscent of the administration of *takra* in such conditions is the administration of cultured fermentative organisms such as those of sour milk namely *bacillus Bulgaricus*.

It may be noted here that the microbes of large intestine or *bṛhadantra* perform two types of actions namely fermentation and putrefaction. The former term describes the action of a living organism in causing *bhinna-saṅghāta* or the split of complex substances into their simplest components. An outcome of bacterial fermentation is the production of different kinds of gases. This may be illustrated with the example of the preparation of *āsavas* and *arīṣṭas*. It may be noted here that some products are much more readily fermented in this manner than others. Putrefaction, on the other hand, is a like process and resembles in many ways fermentation with the difference that it refers specifically to *bhinna-saṅghāta* of protein substances rather than carbohydrates into smaller molecules with the liberation of various disagreeable or foul smelling gases such as indol, skatol, phenol, hydrogen sulphide and ammonia etc. The term putrefaction itself means to make rotten.

Apart from the contributions these *sahajakṛmis* which normally inhabit the *bṛhadantra* are said to make to the welfare of the host to which a reference was made earlier the previous paragraph they may, by entering into *kṣudrāntra* and *urdhva āmāśaya* specially when *agnibala* is considerably reduced contribute poisonous substances by putrefying the protein constituents of food. These may be more easily absorbed from *kṣudrāntra* together with faultily formed *rasa* leading to toxæmic conditions answering to the description of *āmavīsa*.

Events, specially the abnormal conditions visualised above may intoxicate cells which constitute the *dhātuvahasrotāṁsi*,

thus bringing about *kha-vaigunya* which latter may lead to *srotorodha* leading in turn to an interaction between the abnormal *doṣas*, *sthānika dhātus*, *doṣas* and *malas* leading to the creation of *malasañcaya* or *doṣacaya* in that locality and thus, to initiate the process of disease. The condition envisaged above corresponds to the description of metabolic-hystotoxic anoxia described earlier in page 116.

#### ĀMA FORMATION DUE TO DHĀTVAGNI MĀNDYA

It is seen that *Dalhaṇa*<sup>1</sup> and *Cakrapāṇi*,<sup>2</sup> in their commentaries on *Suśruta* have stated that the formation of *āma* need not necessarily be due to *jāṭharāgni māndya* only, and it may also occur due to the impairment of *dhātvagnivyāpāra*. It is also seen from *Ātaṅkadarpaṇa*<sup>3</sup> commentary of *Mādhabanidāna* that *āmadoṣa* may be caused due to *māndya* of *dhātvagnis* and *bhūtagnis*, on account of which *śoṣa*, *vraṇa*, *vidradhi* and such other diseases may be caused. It is necessary to bear in mind at this point that the term 'dhātu' used in this context by *Dalhaṇa*, *Cakrapāṇi* and *Vācaspativaidya*, refer to *asthāyi* or *poṣaka dhātus* and the *agni* referred to in this context is *dhātvagni*. In contrast, the *agni* present in *sthāyi* or *poṣya dhātus* are *pācakāṁśas*. While, *jāṭharāgni pāka* refers to digestive events, the *dhātvagni pāka* relates to intermediary metabolism and *pākas* carried out by these *pācakāṁśas* in *sthāyi dhātus* relate to the synthetic and maintenance metabolism in them. The *vaiśamya* of *dhātvagni* referred to by *Dalhaṇa*, *Cakrapāṇi* and *Vācaspativaidya*, leads to the impairment of intermediary metabolism resulting in the production of incompletely metabolised substances which are obviously not

1. कथं रसशापकवेति विरोधनीयं वचनम् ? न शापको रसः व्यपदेशं लभते । सत्यं, जाठरेणाभिना रसः कद्मावेन कृतएव, किन्तु धात्वभिन्नरपाकादाम इत्युच्यते । *Dalhaṇa* on *Suśruta* : *Sutra* 15 : 35.
2. आमएव इति इवार्द्धमेवक्षादः रक्तादिरूपेणापरिणततयाऽपक इव इत्यर्थः ; न तु 'आमाशयस्वः कायाम्नेदैर्वैस्यादविपाचितः' इत्यादिना उक्तः, तस्य रोगहेतु-तयाऽऽमाशयस्थवेन च मेदोजनकायोगात् । *Cakrapāṇi* on above.
3. एतावता धातुभूतानीना मान्चत्वेनामसंभवत्वात् शोषवृणविद्ध्यादिरोगाणां तज्जन्यस्वमुक्तं भवति…… । यत्र धातुपदेशे वहिमन्दो भवति तत्रैवामसंभवात् पीडकायुस्त्वचिः स्यात् । *Ātaṅkadarpaṇa* on *Mādhabanidāna* 6 : 22.

fit for utilisation by the *sthāyi dhātus*. Thus, these products are in *āma* state and cause *āmadoṣa* at this level.

The clarification offered above may be amplified thus : *Dhātavagni pāka*, it is obvious, furnishes the elements necessary for the synthesis of *sthāyi dhātus* as well as energy-linked substances to produce the units of energy required for synthetic events. Proceeding on the basis that amino-acids contribute to the brick blocks with which cellular proteins are synthesised special enzymes are seen to be required for the transferance of oxidative energy through phosphorilation. It was noted in page 48 that hydrolytic breakdown of proteins in cells occur entirely through cathepsins. It is seen that the preponderance of this enzyme-activity depends upon a number of factors of which the followings are important, the concentration of amino-acids, pH, temperature, oxygen-tension, source of energy, the quality and condition of co-enzymes concerned with the utilisation of energy through oxidative process, the presence or absence of toxic deleterious substances and the influence of certain hormones.

*Table furnishing conditions necessary for synthetic activity or otherwise.*

Normal conditions.	Abnormal conditions.
1. Normal concentration of amino-acids	1. Abnormal concentration of amino-acids.
2. Normal pH	2. Abnormal pH
3. Normal temperature	3. Abnormal temperature
4. Normal oxygen-tension	4. Abnormal oxygen-tension
5. Unimpaired source of energy	5. Impaired source of energy
6. Presence of co-enzymes of good quality and condition	6. Absence of co-enzymes or their presence in bad quality and condition
7. Absence of toxic or deleterious substances	7. Presence of toxic or deleterious substances
8. Influence of certain hormones.	8. Absence of the influence of certain hormones.

*Note*—Conditions entered in column two above lead to *āma-dosha* at the intermediate and cellular metabolic levels.

Details of the processes by which factors mentioned above operate are almost completely unknown. It is, however, seen that certain broad generalisations have been made. The synthesis is an endo-thermic reaction. It can take place in cells only if energy is made available. The endo-thermic reaction mentioned above is invariably anaerobic in nature and is comparable to *bhūtagni vyāpāra* as described in page 72-73. A function of *pācakāṁśas* in *dhātus* would generally appear to be oxidative or aerobic. The source of energy referred to above is seen to be derived from the oxidation of small organic substances, such as pyruvic acid, derived from the intermediate metabolism of glucose, fatty-acids and amino-acids. A series of enzymes are seen to be involved for the utilisation of oxygen that has been transported into cells, in step by step processes which involve small exchanges of energy. But at any stage the energy transformation can be impeded by substances which inhibit or poison the enzyme system involved in this stage.

Thus, the inhibition of poisoning of the enzyme system involved both at the intermediary and the cellular levels has a parallel to the views on *āma-dosha* due to *dhātvgani* and *bhūtagni māndya*, advanced by Dalhana, Cakrapāṇi and Vācaspativaidya.

Food	+	<i>jātharāgni</i> ( <i>manda</i> ) → <i>āma</i> causing disease in <i>mahāsrotas</i> . Also, some portion of it is absorbed to cause generalised symptoms.
↓		
+		
<i>jātharāgni</i> ( <i>sama</i> )		
↓		
<i>Āhāra rasa</i>		
( <i>Upādāna rasa</i> )	+	<i>Bhūtagni</i> and <i>Dhātvgani</i> ( <i>manda</i> ) → <i>āma</i> , causing disease all over the body.
↓		
+		
<i>Dhātvgani</i> ( <i>sama</i> )		
1. <i>Asthāyi dhātu</i>	+	<i>Pācakāṁśa</i> ( <i>manda</i> ) → <i>Vṛddhi</i> of the specific <i>dhātu</i> .
2. <i>Asthāyi dhātu</i>	+	<i>Pācakāṁśa</i> ( <i>tikṣṇa</i> ) → <i>Kṣaya</i> of the specific <i>dhātu</i> .

## SARIRA BALA

*Bala* in ordinary parlance is strength. From a strictly technical point of view *bala* has two aspects viz., (a) the capacity to perform work or *karmaśakti*<sup>1</sup> (b) the capacity to resist or overcome diseases and *vyādhikṣamatva*. In general *bala* is stated to be of three kinds.<sup>2</sup>

(a) *Sahaja* or inherited i.e. natural.

(b) *Kālaja* (Seasonal or in different ages of life)

(c) *Yuktikṛta* or strength promoted by such measures like *rasāyana* etc.

These three different kinds of *balas* may refer both to *karmaśakti* and *vyādhikṣamatva*. The proper functioning of *antarāgni* is the *sine-qua-non*, in either case. The author has confined himself, in this paper to the study of *bala* with reference to *karma*. *Vyādhikṣamatva* is a subject by itself and needs special study. In view of paucity of time the author of this thesis has confined himself only to the *karmaśakti* aspect of *bala*.

*Karma* or *vyāyāmaśakti* is obviously a function related, in main, to *kapha* and *māṁsadhātu*. *Māṁsa* is one of the main *sthānas* of *prākṛta kapha*. The former is seen to endow *sthairyā* (sturdiness and firmness) and *drḍhatā* (hardiness) to the body. Thus, *vyāyāma* is stated to promote well-formed, broad and rotund limbs, confer lightness to the body, agility and dexterity in the performance of work, healthy appetite and slimness of the body<sup>3</sup> (this relates to the reduction of body-fat). It is of importance to note that *vyāyāma* is stated to reduce *medas*, while promoting *vibhaktaghanagātratva*, which latter refers to an increase of *māṁsadhātu*. According to *Dalhana*, *bala* is to be determined by one's power or capacity to lift and bear heavy loads etc. "bhāraharanādi-śakti-gam-

1. कर्मशक्त्या शानुमीयते बलत्रैविष्यम् । *Caraka* : *Vimāna* 8 : 121.

2. त्रिविधं बलमिति सहजं कालजं युक्तिकृतं च । सहजं यच्छ्रीरसस्वयोः प्राकृतम्, कालकृतमृतुविभागजं वयःकृतं च, युक्तिकृतं पुनस्तथादाहरचेष्टायोगजम् ।

*Caraka* : *Sutra* 11 : 36.

3. लाघवं कर्मसामर्थ्यं दीप्ताद्विमेंदसः क्षयः ।

विभक्तधनगात्रत्वं व्यायामादुपजायते ॥ *Aṣṭāṅgahṛdaya* : *Sutra* 2 : 10.

*yasya*<sup>1</sup> and Suśruta has referred *bala* to well formed, well knit, compact and stable musculature of the body.<sup>2</sup> The term “*sarvaceṣṭāsu apratighāta*” used by him in this connection refer to the power implicit in *bala* to overcome forces of opposition in the performance of work or action. Force that opposes actions like lifting and bearing heavy loads running against gradients, climbing a hill etc., is expressed by or reflected through the activities of *māṁsa* which overcomes opposition of various kinds in the performance of work specially such as those mentioned above.

The foregoing relate to the functions of different kinds of muscles of the body and in special to the skeletal muscles. As regards other kinds of muscles, the action of skeletal muscles is supported by the *māṁsapeśi* of *hṛdaya* (cardiac muscle) which by its constant contraction and relaxation enables the organ to beat and supply *rasa* cum *rakta* to all parts of the body, thus providing them with *indhana*; which the *māṁsa* *peśis* of the hands, legs and other parts of the body burn to make available *śakti* to perform work. *Māṁsapeśis* of *āmūśaya* ( both *urdhva* and *adho* ) known as visceral or plain muscles, provide nutrition to the body churning the food, passing it through the intestine and thus, aiding the process of digestion. It is seen that about half of physical, chemical and metabolic processes occur in *māṁsapeśis* and at least 3/4th of the total metabolism is due to severe exercise. Even otherwise, much of the body heat is produced by *māṁsapeśis* as compared to other *dhātus*.

Even though three grades of *bala* viz., *pravara*, *madhya* and *avara* have been mentioned by Caraka<sup>3</sup> an objective description of them have not been mentioned in the related literature. The author in this thesis has attempted to provide objective and measurable values to these three kinds of *balas*.

१. एतद् भारहरणादिशक्तिलक्षणेन बलेन ।

Dalhaṇa on Suśruta : *Sutra* 15 : 19.

२. तत्र बलेन स्थिरोपचित्तमांसता सर्वचेष्टास्त्रप्रतिष्ठातः स्वरबणप्रसादो वायानामाभ्यन्तराणां च करणानामात्मकार्ये प्रतिपचित्तमंवति । Suśruta : *Sutra* 15 : 19.
३. एवं प्रकृत्यादीनां विकृतिवज्यानां भावानां प्रवरमध्यावरविभागेन बलविशेषं विभजेत् । Caraka : *Vimāna* 8 : 123.

## SECTION IV

### AGNIBALA PARIKSHA

Prior to proceeding to the practical study of *agnibala*, it is necessary to examine the existance of a possible correlation among *agnibala*, as understood from *jaranyaśakti* ( digestive capacity ), *bala* as evidenced by *vyāyāma śakti* ( capacity to perform physical work ) and *mātrā* of *uṣmā* ( quanta of heat ) generated by the body, with all of which, *pūcakāgnī* is concerned. A reference to the scheme in between pages 44-45 relating to the inter relationship that exists between *pūcakapitta* on the one hand and other *pittas*, as well as, *agnis*, on the other, will show that the former plays a vital role, ( 1 ) in the preparation of *indhana* from the food in the *āmāśaya*, ( 2 ) the processing of this *indhana* suitably in *dhātvagnipāka* for the utilisation by the *sthāyi dhātus* and ( 3 ) the actual burning of the *indhana* to produce the energy for work by *pūcakāniśas* present in the *sthāyi dhātus*, especially in the *māṁsadhātu*. An outcome of this process is the generation of heat. Heat, thus produced, represents the degraded aspect of energy left over after the performance of work.

*Āhāra+jāṭharāgnī→upādāna rasa ( anna rasa );*

*Upādāna rasa + Dhātvagni→Indhana.*

*Indhana + Pūcakāniśas→dhātukarma ( energy ) + uṣmā*

( heat ) + ap ( water— $H_2O$  ).

That *dehāgni* is the basis of *bala* ( strength ), *ārogya* ( positive health ), *ayus* ( longevity ), *prāṇa* ( élan-vital ), *varṇa* ( complexion ), *utsāhopacaya* ( increase of cheerfulness ), *prabhā* ( lustre ), *ojas* ( resistance to disease and decay ), *tejas* ( energy ) and other *agnis* of the body is seen from the observation of Caraka.<sup>1</sup> According to him *agni* blazes being fed with fuel derived from *anna* and *pāna*.<sup>2</sup> *Yogaratnākara*,

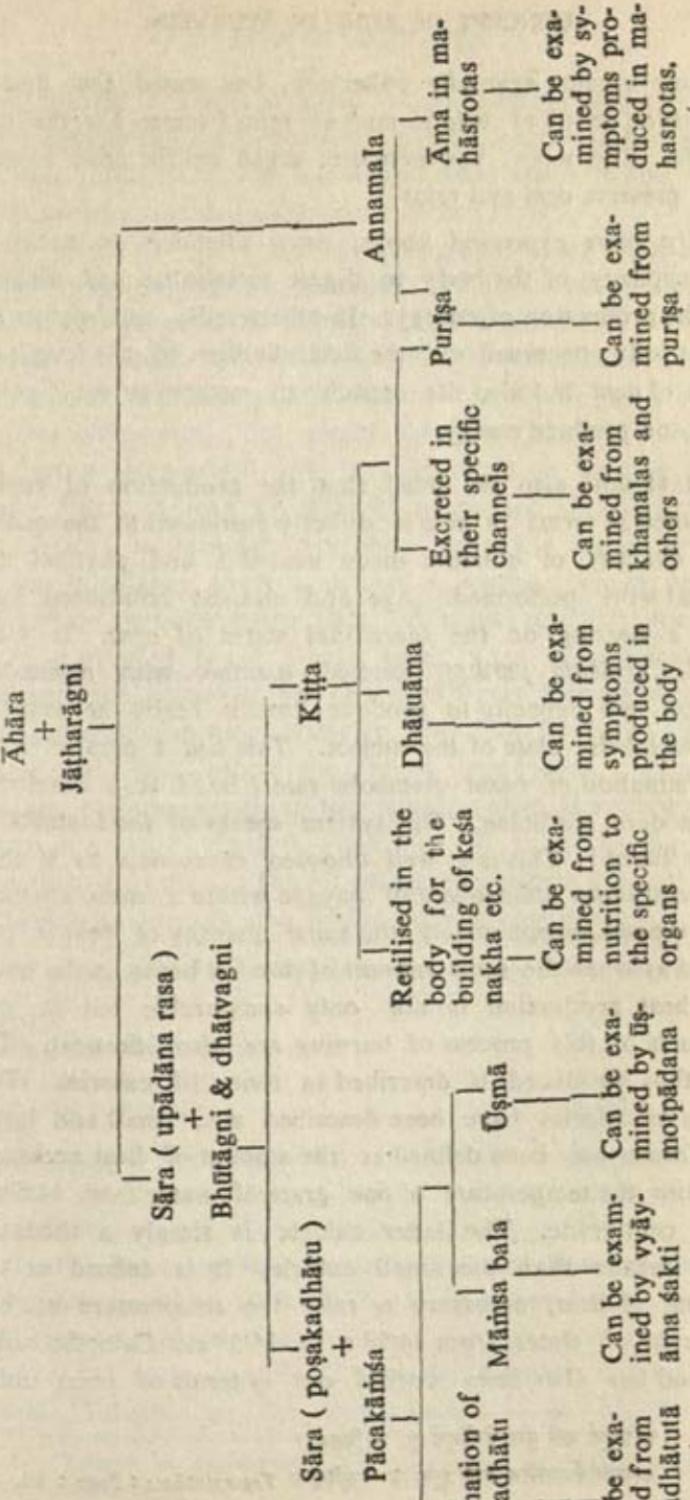
1. (a) आयुर्वर्णो वलं स्वास्थ्यमुत्साहोपचयः प्रभा ।

ओजस्तेजोऽप्यः प्राणाश्चोक्ता देहाप्निहेतुकाः ॥ *Caraka : Cikitsā 15 : 3.*

(b) वलमारोम्यमायुश्च प्राणाश्चाश्चौ प्रतिष्ठिताः । *Caraka : Sutra 27 : 342.*

2. अश्वपानेन्वनैश्चाप्निर्वलति ष्वेति चान्दया ॥ *Ibid.*

## SCHEME SHOWING DIFFERENT ASPECTS OF AGNIBALA PARIKSHA



a more recent Āyurvedic collection, has stated that *agni* is the *mūla* (root) of *bala* in man as *retas* (semen) is the root of life. This work, has therefore, urged on the need to carefully preserve *agni* and *retas*.<sup>1</sup>

The views expressed above, draw attention to nutrition, the capacity of the body to digest metabolise and utilise it for the production of energy. In otherwords, *agnibala parikṣā* is not only concerned with the determination of the functional state of *agni* but also its capacity to metabolise the digested food and produce energy.

It should also be noted that the production of energy measured in terms of heat is directly correlated to the quality and quantity of nutrition made available and physical and mental work performed. Age and climatic conditions have also a bearing on the functional states of *agni*. In other words, *agnibala parikṣā*, studied together with *māṁsabala parikṣā* and capacity to produce *uṣmā* is really the study of the metabolic state of the subject. This has a parallel in the determination of basal metabolic rate (B. M. R.) developed by modern medicine. This system speaks of food stuffs as being 'burnt.' This is a well choosen expression as if food is placed in an atmosphere of oxygen within a metal chamber and ignited approximately the same quantity of heat is produced as when the same amount of food is burnt in the body. The heat production is not only comparable but the end products of this process of burning are also identical. The heat thus produced is described in terms of calories. Two forms of calories have been described viz., small and large. The former has been defined as the amount of heat necessary to raise the temperature of one gram of water from 14.5° to 15.5° centigrade. The latter calorie is simply a thousand times greater than the small calorie. It is defined as the amount of heat, necessary to raise the temperature of one kilogram of water from 14.5° c to 15.5° c. Calorific value of food has also been worked out in terms of gram units.

1. अग्निमूलं वर्णं पुंसा रेतोमूलं तु जीवितम् ।

तस्मात्सर्वप्रयत्नेन वर्हि शुक्रं च रक्षयेत् ॥ *Yogaratnīkara* : Page : 10.

Thus protein is stated to yield 4.1 calories per gram in the body, carbohydrate 4.1 calories and fat 9.3 calories per gram. The end products of the burning of food stuffs in the body yields carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ).

As stated in the previous paragraph, heat production depends upon metabolic processes and these processes vary with subject's activities. Metabolic determinations are being carried out under well defined and rigid conditions. It has been shown that the more active the individual, the faster is his metabolic rate. Conversely this rate falls to its lowest ebb during sleep which has been described as the true basal level. Since, it may be difficult to induce sleep whenever one decides to measure metabolic state the basal level is always calculated when a subject is awake, but at perfect rest and in post-absorptive state. In actual practice, the subject is instructed to eat a light meal in the night before the determination, retire to bed to ensure about 8 hours sleep, to refrain from the excessive exercise for atleast 24 hours and to forego break-fast before the test is conducted. Metabolic tests are performed early in the morning after the subject has rested in a quite semidark room for 30 minutes. Then the estimation proceeds. The following represents the heat production in an average man under varying conditions.<sup>1</sup>

Activities or occupation	Calories per day
Sleeping	1560
Resting but awake-sitting up	2400
Light exercise—slow walk	4080
Exhaustive exercise	15000
Tailor	2950
Stone mason	9100
Typist	2575
House maid	3840

It will be noted that the procedure and findings as described above relate to B. M. R. It does not furnish any information as regards the optimum average output of heat which a subject is capable of generating under normal conditions. Valuable as the determination of B. M. R. is, a

1. Langly & Cheraskin: The physiology of Man: Page 435, 4th Edition.

study of the optimum average heat out-put in a given individual would also appear to be equally important. The present study relates to the latter aspect.

Before proceeding to the description of actual practical study undertaken by the author in the above regard it is necessary to take into account the signs and symptoms of the normal and abnormal states of *antarāgni*, having regard to inherited tendencies, season and age as described in the *samhitās*. In fact, the findings reported in this thesis, are based on *lakṣaṇas*, relating to various conditions described above.

TABLE I.  
GENETIC ASPECTS OF AGNI<sup>1</sup>

Prakṛti or Temperament	State of agni
<i>Sama prakṛti</i>	<i>Sama</i> or normal state
<i>Vāta prakṛti</i>	<i>Viṣama</i> or erratic state
<i>Pitta prakṛti</i>	<i>Tikṣṇa</i> or acute state
<i>Kapha prakṛti</i>	<i>Manda</i> or dull state

TABLE II.  
STATE OF AGNI OR JARĀNAŚAKTI SEASON-WISE

Season	State of agni
<i>Grīṣma</i> ( June and July )	<i>Durbala</i>
<i>Varṣā</i> ( August and September )	<i>Durbala</i> or weak <sup>2</sup>
<i>Sarāt</i> ( October and November )	?
<i>Hemanta</i> ( December and January )	<i>Tikṣṇa</i> or acute <sup>3</sup>
<i>Śiśira</i> ( February and March )	<i>Tikṣṇa</i> or acute <sup>4</sup>
<i>Vasanta</i> ( April and May )	<i>Manda</i> or weak <sup>5</sup>

1. एते चतुर्विधा भवन्त्यग्नवश्तुविधानामेव पुरुषाणाम् । तत्र समवातपित्तश्लेष्मानां प्रकृतिस्थानां समा भवन्त्यग्नयः, वातलानां तु वाताभिभूतेऽन्यविष्णाने विषमा भवन्त्यग्नयः, पित्तलानां तु पित्ताभिभूतेऽन्यविष्णाने तीक्ष्णा भवन्त्यग्नयः, इलेम्लानां तु इलेम्लाभिभूतेऽन्यविष्णाने मन्दा भवन्त्यग्नयः । *Caraka* : *Vimāna* 6 : 12.
2. आदानदुर्बले देहे पक्ता भवति दुर्बलः । स वयास्वनिलादीनां दूषणीर्वाच्यते पुनः ॥ *Caraka* : *Sūtra* 6 : 33.
3. शोते शोतनिलस्पर्शसंरुद्धो वलिनां वली । पक्ता भवति हेमन्ते मात्राद्रव्यगुरुक्षमः ॥ *Ibid* : 9.
4. हेमन्तशिशिरी तुस्यौ शिशिरेऽप्यं विशेषणम् ॥ *Ibid* : 19.
5. वसन्ते विचितः इलेम्ला दिनकृच्छाभिरोरितिः । कायाम्भिं वाष्टे रोगास्ततः प्रकुरुते वद्धन् ॥ *Ibid* : 22.

TABLE III.  
STATE OF AGNI OR JARANAŠAKTI AGE-WISE

Age	State of agni
<i>Vṛddha</i> ( Old age )	<i>Manda</i> or dull <sup>1</sup>
<i>Yuvā</i> ( Youthful )	<i>Tikṣṇa</i> or acute <sup>2</sup>
<i>Bala</i> ( Child )	<i>Manda</i> or dull

TABLE IV.

The table below furnishes *lakṣaṇas* ( signs and symptoms ) of normal state of digestion.<sup>3</sup>

Signs		Symptoms	
<i>Sārira</i> ( Physical )	<i>Mānasa</i> ( Mental )	<i>Sārira</i> ( Physical )	<i>Mānasa</i> ( Mental )
<i>Udgāra Śud- dhi</i> ( normal eruption )	<i>Utsāha</i> (Cheer- ful- ness )	Eruption of sweet taste at the beginn- ing of digestion, sour taste in the middle and saline taste at the end.	<i>Viśuddha</i> ( a sense of clean- liness )
<i>Vegotsarga</i> ( Passing mo- tion with force )	:	Absence of <i>dāha</i> or burning sensation in the stomach or chest.	<i>Viśada</i> ( clear- ness of mind )
<i>Yathocitotsarga</i> ( Passing mo- tion depending upon the na- ture of the diet )		Lightness of the body.	<i>Sukha</i> ( plea- sure )
<i>Svasthavṛttanu- vṛtti</i> (Conti- nuity of health)		Aptitude for work.	<i>Kāṅkṣā</i> ( Desi- re for food )
		Appetising sensa- tion.	<i>Pipāsā</i> ( sen- sation of thirst ).
		<i>Sthiratā</i> ( sturdi- ness )	

1. ( तस्यैवाग्निः ) कदाचिन्मन्दो भवति यथा वर्षासु वार्षक्ये च,

Cakrapāṇi on *Caraka Sutra* 5 : 3.

2. तस्यैवाग्निः कदाचिद्वृद्धो भवति यथा—हेमन्ते यौवने च, *Ibid.*

3. (a) उद्धारशुद्धिरुत्साहे वेगोत्सर्गो यवोचितः ।

लघुता भ्रुतिप्राप्ताच शीर्णद्वारस्य लक्षणम् ॥

*Mādhabanidīna* 6 : 24, *Bhāṣa prakāśa* : *Yogaratnīkara*.

*Agni* or *jarānaśakti* has also to be considered in the light of the digestibility of food substances. Accordingly foods which are not easily digestible are to be eaten up to half of one's satisfaction.<sup>1</sup> As regards articles of diet which are light or easily digestible they are to be eaten up to one's full satisfaction<sup>2</sup> or slightly less than that.<sup>3</sup> It is necessary to

(b) काङ्गा तुमुका वैशयं लघुता स्थिरता सुखम् ।

स्वस्वत्तानुशृतिश्च सम्यग् जीणस्थलक्षणम् ॥ *Kaṣyapaśāṁhitā* : *Sutra* 24.

(c) मधुरः पूर्वमुद्गारो मध्ये चाम्लो तथा मधेत् ।

पश्चात्तलवणकथापि नहि दाहो भवत्यथ ॥

लाघवं वीमुते कार्यं विशुद्धं विशदं सुखम् ।

प्रगुणं कुरुते पादमूर्खं वा यदि वाप्यथः ॥

मोक्तुं अद्वा भवत्यस्य रुजा ( कुरु ) चान्यो ( चास्यो ) पशान्वति ।

इत्येमिलेषुजीवीयं विशादतं शरोरिणाम् ॥ *Bhelaśāṁhitā* : *Sutra* 10.

(d) भुदेगमेष्वौ लघुता विशुद्धिजीणलक्षणम् । *Caraka* : *Cikitsa* 30 : 303.

1. (a) गुरुणामर्थसौहित्यं…… । *Suśruta* : *Sutra* 46 : 530.

*Aṣṭāṅgahṛdaya* : *Sutra* 8 : 2.

(b) गुरुणामल्पमादेयं…… । *Caraka* : *Sutra* 27 : 341.

2. लघुनां तुमिरिष्यते । *Suśruta* : *Sutra* 46 : 530.

3. लघुनां नाति तुमता । *Aṣṭāṅgahṛdaya* : *Sutra* 8 : 2.

The *gurutea* and *laghutes* of *śhāra* and *ausadha dravyas*, described here is in relation to their digestibility or otherwise, which are to be judged from the point of view of *agni*. Nonetheless, it is seen from *Caraka* (*Vimāna* 1 : 22) that *śhāra* and *ausadha dravyas* have been classified as *laghu* or *guru* from two points of view viz., ( 1 ) *Seabhāṣa* or *prākṛta* ( natural ) and ( 2 ) by *samskāra* or by suitably processing the material.

Examples of No. 1 above are *mūṣa* ( bengal gram ) and *śūkara* ( pig ), as regards *śhāra dravyas* which are naturally *guru* or difficult of digestion and *mudga* ( green gram ) and *ēṇa* ( deer ) and the classical examples of *dravyas*, those are *laghu* or easily digestible. As regards No. 2, substances rendered digestible or otherwise by subjecting them to different forms of processings like ( 1 ) the addition of water as by soaking, ( 2 ) the application of heat as by cooking or frying, ( 3 ) churning, ( 4 ) emulsifying, ( 5 ) storing them for fixed duration of time, ( 6 ) by maturation, ( 7 ) by flavouring, ( 8 ) impregnation, ( 9 ) preservation, ( 10 ) and by keeping them in selected containers (*Caraka* : *Vimāna* 1 : 22).

note in this connection that the term '*trpti*' refers to feeling or sensation of satisfaction which is a highly individualised subjective criterion. The individual subject is in the final analysis the ultimate judge of it. There can be objective average standard by which *trpti* can be measured. In addition, a good nutrition should (1) appeal to the sense of taste, sense of smell and sight. In other words it should be tasty, possess pleasing odour and should not displease or offend the eye<sup>1</sup> (2) be capable of filling the stomach (3) contain all the proximate principles of nutrition. From *Āyurvedic* point of view, *dravyas* representing the six kinds of *rasas* (*madhura rasa* dominating) constitute the balanced diet.<sup>2</sup>

From the point of view of modern nutritionology, apart from substances having qualities mentioned above in 1 and 2, a balanced diet should consist of an adequate quantity of proteins with biological value, fats, carbohydrates, minerals, water and vitamins, in keeping with the age, sex, climate, season and the kind of physical or mental work which the person does. All these factors can be classified from the point of view of their *rasa* or taste.

#### ŚAKRT OR STOOL IN RELATION TO AGNIBALA

An important criterion of normal digestion is as related to the nature of faeces or *śakṛt*, voided by an individual. It has been recognised by *Āyurveda* that the nature of faeces, even under normal conditions depends to a large extent upon the nature of the diet consumed.<sup>3</sup> All things being equal, the normal faeces has a reference to the normal state of digestion. In fact, *mala parikṣā* forms part of *āṣṭasthāna parikṣā* as described in *Yogaratnākara*.<sup>4</sup> Not notwithstanding the importance attached to the examination of *mala*, *mūtra* and other excre-

1. इष्वर्णगन्धरसपर्श्च विविविहितमन्नपानं प्राणिना प्राणसंशकाना प्राणमाचक्षते कुशलाः । *Caraka : Sutra 27 : 3*
2. पद्मसं मधुरप्रादं……अहनीयात् । *Aṣṭāṅgahṛdaya : Sutra 8 : 36*
3. उद्धारशुद्धिरसाहो वेगोस्तंगो यथोचितम् ।  
लघुता लुत्पिपासा च जीर्णाहारस्य लक्षणम् ॥ *Madhavanidāna 6 : 24*  
यथोचित उपयुक्ताहारानुरूपः । *Vijayarakṣita* on above.
4. रोगाकान्तशरोरस्य स्थानान्यष्टौ निरोक्षयेत् ।  
नांडीं मूत्रं जिर्हां शब्दं स्पर्शं दृग्कृतीः ॥ *Yogaratnākara*.

ments, direct reference to the nature of normal faeces has not been made in the available editions of Āyurvedic literature. However, description of pathological aspects of faeces have been furnished here and there. The author of this thesis has worked out the qualities of probable nature of normal faeces, which has formed the basis of his investigation.<sup>1</sup> They are furnished in the table below :

Appea- rance	Consti- tency	Colour	Smell	Other related data
<i>Snigdha</i>	<i>Samhata</i> ( Semi solid )	Having colours except <i>śyāva pita</i> ( yellow ) <i>nila</i> (blue) <i>rakta</i> (red) and <i>śveta</i> ( white )	Less foul smell	No <i>sūla</i> or colicky pain. <i>Srsta mūtra</i> or free mituration No gurgling sound of the intestine No sensation of weakness of the thigh, lumber and calf region Passage of motion in one bulk Not frothy Motion without passage of gas Having moderate temperature Free from thirst, fits, burning sensa- tion, inflammation, fever etc. Clearness of mind Sound sleep Lightness of the body Free from eructa- tion

The findings noted in the table above may have to be supplemented with additional facts of observation to make

1. संस्कृतमेमिदौपैस्तु न्यस्तमप्स्ववसीदति ।

पुरीयं भृशदुर्गन्धं विभिन्नत्रामसंहितम् ॥

एतान्येव तु लिङ्गानि विपरीतानि यस्य तु ।

काषवं च शरीरस्य तस्य पक्वं विनिर्दिशेत् ॥ *Sufruta : Uttaratantra* 40 - 1

the study of normal faeces complete. In appearance the normal stool is roughly cylindrical<sup>1</sup> "having the consistency of butter in summer time"<sup>2</sup>; it may vary from solid to semi-solid.<sup>3</sup> The appearance of stool depends upon the consistency as well as integrity of the passage. It depends to a large degree on the water content or stated differently on the degree to which the process of water absorption has been carried out. Certainly, other factors, such as gastro-intestinal motility and nature of diet, affect the consistency of faeces also. Small variations in diet have little or no effect on the nature of faeces. However, an exclusively vegetable diet tends to yield a larger bulk and softer consistency faeces while on a meat diet the faeces are harder and the quantity is less."<sup>4</sup> Colour of the normal stool may vary from light to dark brown due to stercobilinogen "chlorophyll and other pigments."<sup>5</sup> As regards smell, it is foul and offensive due to some fermentative and putrefactive products—gases-like indol, skatol, ammonia, hydrogen sulphide etc.

It is necessary, in passing, to advert to the colour of the normal *puriṣa*. There is no direct reference to this aspect of the physical qualities of *puriṣa* in the available editions of *Saṁhitāgranthas*. However, it is seen from a reference made by Cakrapāṇi<sup>6</sup> that in *Koṣṭhāśrita Kāmala*, the colour of the *śakṛt* resembles that of *tilapiṣṭa* (gingili cake) or *svetavarcas*. This is stated to be due to the non-availability of *malarājaka pitta* on account of obstruction to its excretion in the concerned *srotas*. Factually speaking, the condition envisaged by Cakrapāṇi resembles the description of obstructive jaundice in which due to "obstruction of the entrance of bile to the intestine faeces of the colour of *tilapiṣṭa* or *svetavarcas* (pale coloured stool) is voided. The pigment which usually colours

1. Savills system of Clinical medicine 13th edition, page 368.
2. Machinary of the body.
3. Savills system of clinical medicine, page 368.
4. West & Todd : A text book of Biochemistry, 1955 Edition.
5. Savills system of clinical medicine.
6. शेतवचां इति कोष्ठस्य पित्तस्य मलरंबकस्य वहिनिंगमाद्युद्देन शेषमणा शेतवचां भवति । Cakrapāṇi on *Care of Cittas*.

the faeces is seen to be stercobilin, a product of oxidation of the precursor stercobilinogen which latter is derived from bilirubin a bile pigment (bilirubin is a breakdown product of R. B. C.). This pigment imparts to the normal faeces, its dark brown colour. Hence, the normal dark brown colour of the *puriṣa* has a reference to *malarañjaka pitta*. Thus, the study of the colour of *puriṣa* offers information relating not only to the functions of *rakta* and *pitta sthānas* like *yakṛt* and *plihā*, but also, to the *rakta* itself.

Normal and abnormal diagnostic events in different parts of koṣṭha and corresponding symptomatology.

Organ	Normal function	Abnormal function	Symptoms in abnormal function.
Urdhva-āmāśaya	Madhura-avasthā pāka	Sukta-pāka ( Fermentation )	Gurutā or Heaviness
	Amla avasthā-pāka	Apakvānna ( non digestion of food )	Utkleda
	Bhinnasamghīta		Gaṇḍa & aksikīṭa śotha
	Anna mārdava karapa		Udgāra
Adho-āmāśaya	Amla avasthā pāka	Apakvānna ( non digestion of food )	Avidagdha-pravartana ( ūrdhvamārga )
	Rasaśoṣaṇa		Bhrama
	Sārakīṭa-vibhajana		Tī
		Āma formation	Mūrchā
		"Bahupicchila (Extreme sliminess)	Oṣa
			Coṣa
			Dāha

Organ	Normal function		Abnormal function	Symptoms in abnormal function
	Drava-śoṣaṇa	Mala-mūtra vibhājana		
Pakvāśaya	Daurgandhya ( foul smell )	Atidrava-śoṣaṇa	Amla-udgāra	Āmla-udgāra
	Mala-mūtra vibhājana	Alpadrava-śoṣaṇa	Śūla	Śūla
	Piṇḍikaraṇa	Impaired vibhājana	Ādhmīna	Ādhmīna
	Vāyu-upādāna dravyotpatti	Improper piṇḍikaraṇa	Toda, Bheda etc.	Toda, Bheda etc.
	Malarūpa vāyu pravartana	Formation of more vāyu ( malarūpa )	Mala apravṛtti.	Mala apravṛtti.
		Less formation of upādāna dhātūrūpa vāyu.	Vāta apravṛtti.	Vāta apravṛtti.
		Māyāvāyu	Stambha	Stambha
		Māyāvāyu	Moha	Moha
		Māyāvāyu	Āṅgapīḍana	Āṅgapīḍana
		Māyāvāyu	Drava mala pravartana	Drava mala pravartana
		Māyāvāyu	Ājāśakṛvāt mala pravartana.	Ājāśakṛvāt mala pravartana.

## Physical characteristics of normal and abnormal states of puriṣa ( faeces )

Physical properties	Normal	Abnormal with cause
	Consistency & shape	
1. Solid to semi solid	1. Hard, dry roundish balls ( ajaśakṛdvat ) and generally coated with mucus, known as scybala due to defective intake of fluid or its excessive absorption by a greedy colon	1. Hard, dry roundish balls ( ajaśakṛdvat ) and generally coated with mucus, known as scybala due to defective intake of fluid or its excessive absorption by a greedy colon
2. Cylindrical	2. Pencil like, due to spasm of the anal sphinctor, possibly associated with anal fissure	2. Pencil like, due to spasm of the anal sphinctor, possibly associated with anal fissure
Colour	Light to dark brown.	3. Ribbon like, due to colopasm or stricture of rectum resulting from cancer, syphilis or gonorrhoea 4. Uniformly fluid, due to lesions of the small intestine like typhoid, sprue and Tuberculous or simple enteritis 5. Slimy & more fecal due to lesions of the large bowel 1. Lighter colour in diarrhoea 2. Pale colour due to ( a ) obstruction to the entrance of bile into the intestine as in jaundice ( b ) dilution of the stool as in cholera ( c ) Excess of unabsorbed fat ( d ) a milk diet 3. Clay coloured stool due to obstructive jaundice

Physical properties	Normal	Abnormal with cause
Physical properties	<p>Brown Yellow to green Yellowish green Yellowish brown Black</p> <p>Odourless Faint to strong Faint to strong Faint to strong Faint to strong</p>	<p>4. Pale bulky stool in steato-torchoes, either due to defect in <i>agnyāsaya rasa straya</i> (pancreatic secretion) or defective <i>smelha śoṣapna</i></p> <p>5. Tarry stool due to haemorrhage in upper part of the <i>māhāsrotas</i> as in duodenal ulcer. Black stool also, seen in patients taking iron, bismuth, and charcoal</p> <p>6. "Red current jelly" or strawberry ice stools are seen in intussusception</p> <p>7. Streaks of blood may be present with local lesions like <i>arsa</i></p> <p>8. Muco purulent in <i>pravāhikā</i> etc.</p> <p>9. Green stool due to entritis in infants as well as after the intake of calomel</p> <p>10. Odourless, colourless, rice water stool as in <i>adhogavistuckā</i></p> <p>11. Frothy acid yellow stool due to excessive carbohydrate fermentation</p> <p>12. Soft, brown, offensive alkaline stool of protein putrefaction</p> <p>13. Biliary pea soup stool due to <i>āntrika sanipāta</i></p>

Odour	Foul due to skatol, indol, ammonia & Hydrogen sulphide etc.	I. Characteristic gangrenous smell due to severe ulceration- cancerous dysenteric & syphilitic etc.
Presence of undigested particles of food	Should not be present	Presence of undigested food particle in excess is indicative of imperfect digestion (gastric or impastinal and unless the food has been excessive, denotes especially intestinal or pancreatic disease. In children this feature usually indicates overfeeding
Presence of mucus	Should not be present	When intimately mixed with the faeces it indicates catarrh of the small intestine. When it is present it isolated masses, it signifies the presence of catarrh of the large bowel. When long cylinders of mucus are passed, sometimes without much faeces, it indicates membranous of mucus colitis
Presence of blood	Should not be present	Blood of red colour in streaks or in quantity indicates haemorrhage from rectum or bowel. In haemorrhages from stomach and intestine, the blood undergo partly digested to give the stool a tarry colour
Presence of Pus	Should not be present	Indicates ulceration of rectum or colon which may be ulcerative colitis, dysentery, cancer, tuberculosis or of syphilitic origin
Presence of Gall Stones	Should not be present	Passed from Gall bladder

Physical properties	Normal	Abnormal with cause
Presence of worms	Should not be present (Occasionally the presence of thread worm or Giardia is not taken as abnormality)	Some are macroscopic like round worm <i>Tenia saginata</i> , <i>Tenia solium</i> , <i>Enterobius vermicularis</i> etc. and others are microscopic like the ova of <i>Ascaris lumbricoides</i> , <i>Trichuris trichuria</i> , <i>Ankylostoma duodenale</i> , <i>Oxyuris vermicularis</i> etc.

## SYMPTOMS PERTAINED TO ÜRDHVA AND ADHOAMĀSAYA-DOṢA WISE.

Vata	Pitta	Kapha
Tiktodgāra ( Bitter eructation )	Puti udgāram (foul smelling eructation )	Udgāra bāhulya ( excessive eructations )
Śabda pravala udgāra ( Eructation with great sound )	Amla udgāra ( Acid eructation )	Udgārarodha ( inhibition of eructation )
Saphena chardi ( Frothy vomiting )	Vomiting of green, yellow, red, black, coloured material having sour and bitter in taste. Uṣṇa vamana ( Hot vomitings )	Picchila vamana ( slimy vomiting ) Ślesmayukta vamana ( mucoid vomiting )
Vichina chardi ( Vomiting with splitted material )	Mainsodakābha vamana ( Vomiting of flesh washed water )	Snigdha vamana ( viscous vomiting )
Kṛṣṇa chardi ( Coffee ground vomiting. )	Dhūmra vamana ( Vomiting of foamy substances )	Ghana vamana ( Thick vomiting )
Tanuka chardi ( Thin vomiting )	Kṣārodakābha vamana	Svādu vamana ( Sweet vomiting )
Kasāya chardi ( Astringent vomiting )	Hṛt dāha ( Burning sensation in praecardial region )	Śūkla vamana ( white vomiting )
Kṛchreñchardi ( Painful vomiting )	Alpa chardi ( Vomiting in less quantities )	Śīta vamana ( Cold vomiting )
Bhukte svāsthya ( A sense of ease after taking meals )	Pipāsā ( Thirst )	Tantumāt vamana ( Thready vomiting )

Vata	Pitta	sensation in epigastric area )	Kapha
Svāsa ( Dyspnoea )	Vidaha ( Burning sensation in epigastric area )	Niṣṭhivana ( Spitting )	
Hṛdṛk ( Pre-cardial pain )		Lavaṇa praseka ( saline salivation )	
Āṁśa ṛk ( Pain in shoulder )	Āvipāka ( Indigestion )		
Hṛdayadrava ( Palpitation )	Ajīrṇa Sarana ( Voiding of undigested material )	Tanu praseka Thin ( salivation )	
Prṣṭha śula ( Colicky pain in the back )	Vidāha ( Burning sensation )	Kapha praseka ( Mucoid salivation )	
Agnimāndya ( Poor digestion )	Nabhidesa dāha ( Burning sensation umbilical region )	Utkleśa ( nausea )	
Śukta pāka ( Production of organic acids at the time of digestion )	Jirjati sūla ( Colicky pain during digestion )	Gurutva ( Heaviness )	
Kṣut ( Appetite )		Stimita Kōṣṭha ( Silent gastro intestinal tract )	
Trṣṇā ( Thirst )		Āmāsayaṛk ( Pain in stomach )	
Pārśvaruk ( Pain in flanks )		Śvāsa ( Dyspnoea )	
Parikartika ( Sawing pain )		Aggravation after in taking meals.	
Āntra vikujana ( Sound in the intestines )		Agnimāndya ( Indigestion. )	
Viṣamāgni ( Impaired Digestion )			

## SYMPTOMS PERTAINED TO PAKVĀŚAYA DOŚAWISE

Vata	Pitta	Kapha
<p>Characteristics of the stool voided, are as follows :—</p> <p>Drava ( Liquid ) Suṣka ( Dry ) Taru ( Thin ) Āma ( Undigested ) Sabdavat ( Noisy ) Phenavat ( Frothy ) Grathita ( Scybalous ) Picchānugata ( Slimy ) Kṛṣṇa ( Tarry ) Syāva ( Brown ) Aruṇa ( Redish ) Paruṣa ( Rough ) Vijala ( Slimy ) Vipluta ( which floats and spreads ) Avasādi ( which sinks &amp; spreads ) Āmagandhi ( Having foul putrid smell )</p> <p>Modes/voiding are as follows :—</p> <p>Cirāt ( Delayed ) Duhkha ( with difficulty )</p>	<p>Characteristics of the stool voided, are as follows :—</p> <p>Nīlābha ( Bluish ) Pitābha ( Yellowish ) Pūti ( Putrified ) Uṣṇā ( Hot ) Drava ( Liquid ) Rakta ( Bloody ) Āma ( with undigested food ) Harita ( Green ) Sambhīnna ( Broken ) Pracura ( in large quantities ) Kṛṣṇa ( Black ) Atidurgandhi ( very foul smelling ) Others are :— Vidāha ( Burning sensation ) Pāka ( Proctitis )</p>	<p>Bhinnamala ( Broken stool ) Āma saṁśṛṣṭa mala ( With undigested materials ) Sleṣma saṁśṛṣṭa mala ( mucoid stool ) Guru ( Heavy ) Picchila purīṣa ( slimy stool ) Sveta purīṣa ( white stool ) Snigdha mala ( viscous stool ) Tantumāt purīṣa Thready stool ) Alpamala ( Voiding in less quantity ) Sapravāhīka mala pravṛtti ( Voiding with tenesmus ) Abhikṣṇa mala pravṛti ( Frequent motions ) Viṣṭambha ( constipation ) Vaṅksāpānāha ( Distention of the lower abdomen ) Pāyu vikṛṣṭi ( sucking of anus ) Nābhi vikṛṣṭi ( sucking of umbilicus )</p>

Vata	Pitta	Kapha
Muhurbuddha and muhundrava (some times hard and sometimes liquid )		Vastivikṛṣṭi ( sucking of bladder ) Anubandha śūla ( continuity of colicky pain )
Stoka ( in small quantities )		Sancayadupu vesana ( sudden voiding of large mass of retained faeces )
† Sapravāhika ( with tenesmus )		
Saruk ( with pain )		
Frequent motions		
Other characteristics :—		
Vit sangha ( Retention of faeces )		
Vāta saṅga ( Retention of gas )		
Āṣopa ( Painful distension with sound )		
Ānāha ( flatulence )		
Ādhmāna ( Tymphanitis )		
Viṣṭambha ( constipation )		
Uru-ruk		
Kukṣi ruk		
Trika ruk		
Vasti śūla		
Vāṅkṣaṇa ruk		
Udara vīpaṭāna		
Jīrṇe prakopa		
Āhata ādhmāta		
Drīvat sabda ( Tymphanic sound on percussion )		

*Other Relevant Symptoms pertaining to Gastro-Intestinal Impairment.*

1. Kanṭha śoṣa ( Dryness in throat )
2. Āsyā śoṣa ( Dryness in mouth )
3. Sarva rasagṛddhi ( Desire for substances having all tastes )
4. Kanṭha dāha ( Burning sensation in the throat )
5. Aruci ( Distaste )
6. Trṭ ( Thirst )
7. Āsyopdeha ( coating over the mouth )
8. Āsyā mādhurya ( sweet taste in the mouth )
9. Śṭhivana ( spitting )
10. Vairasya ( Bad taste )
11. Trpti ( Satisfaction )
12. Kaṭu vaktratā ( sensation of acrid or pungent taste in mouth )
13. Praseka ( Salivation )
14. Svarabheda ( Impairment in the production of sound )
15. Kṣavathu ( sneezing )

*Other symptoms relating to Dhātvagni pāka.*

1. Sadana	13. Akṛṣasyāpidaurbalya
2. Sauhityāsaḥatā	14. Strīṣvaharṣaṇa
3. Balakṣaya	15. Ālasya
4. Bhrama	16. Kārṣya
5. Moha	17. Śītajvara
6. Harṣa	18. Gātrastambha
7. Tandrā	19. Sucivedhavatvedanā
8. Santoṣa	20. Staimitya
9. Nidrā	21. Sveda
10. Gaurava	22. Jvara
11. Romaharṣa	23. Dāha
12. Annadveṣa	

AGNIBALA PARĪKṢĀ  
PRACTICAL STUDY

MATERIAL AND METHOD OF STUDY

*Material*—Materials available for the study of agnibala, māṁsa-bala and ūṣmotpatti are :

( 1 ) The description of normal and abnormal symptoms,

pertaining to digestion of food in the *koṣṭha*, as furnished in the available editions of *Saṅhitā granthas*, commentaries thereon and as allied subjects.

( 2 ) Normal volunteers and patients in the hospital, attached to Post Graduate Training Centre in Āyurveda.

( 3 ) Literature relating to *balaparikṣā*, gathered from extent āyurvedic works, as well as from allied modern medical literature.

*Method*—Methods of study, in so far as normal volunteers are concerned, were confined almost exclusively to *māṁsabala* and *tiṣṭmotpatti*. Observations relating to these two factors were noted by the author on the basis of his observation. Data as regards *agnibala* or *jarāṇaśakti* were obtained by interrogating the normal volunteers.

*Agnibalaparikṣā*—Findings subjective and objective, gathered in every patient studied, were recorded in a proforma, specially prepared for the purpose ( vide appendix No. 8 ). Findings relating to *mala parikṣā* were based on unaided sense observation and these were mainly confined to inspection (*rūpa*) and smell (*Gandha*). The data, provided do not include laboratory findings.

*Māṁsabala parikṣā*—In so far as *māṁsabala parikṣā* is concerned normal volunteers as well as patients were requested to run slowly a measured distance on an average not exceeding a mile, in the hostel or hospital compounds and their *ardhaśakti* was noted, having regard to the appearance of beads of perspiration on the fore-head, axillae, nose, joints, extremities and the sensation of dryness in the mouth. This is based on references made by Suśruta<sup>1</sup> and Vāgbhāṭa<sup>2</sup> and commentaries there on relating to the limits, upto which *vyāyāma* or physical exercise is to be practiced.

1. व्यायामो हि सदा पश्यो बलिनोऽस्तिष्यमोजिनाम् ।  
स च शोते वसन्ते च तेषां पश्यतमः स्मृतः ॥  
सर्वेष्वतुष्वहरहः पुम्निरात्महितैषिभिः ।  
बलस्यार्थेन कर्तव्यो व्यायामो हन्वतेऽन्यथा ॥ *Suśruta: Cikitsa* 24 : 45-46.
2. अर्धशक्त्या निषेष्यत्तु बलिभिः दिनष्यमोजिभिः ।  
शीतकाले वसन्ते च मन्दमेव ततोन्यथा ॥ *Aṣṭāṅgahṛdaya: Sūtra* 2 : 11.

*Vyāyāma* according to these authorities, is to be practiced till the limit of half of one's strength—*ardhaśakti* by those who are strong (*balin*) and who live on viscous and fatty types of foods (*snigdhabhojin*). In addition, the permissible upper limit of strength till which *vyāyāma* can be performed by persons, of the type mentioned above, is confined to *Śitakāla* (*Varṣā*—August and September), *Hemanta* (December and January), *Śiśira* (February and March), and *Vasanta* (April and May) and less during the hotter seasons of the year, namely *Grīṣma* (June and July) and *Sarat* (October and November). *Ardhaśakti* is seen to be a strictly individualised norm, which may vary from person to person, season to season and according to the nature of diets consumed by them. In view of these limiting considerations, the signs and symptoms of *ardhaśakti* of any individual should conform to the following criteria.

(1) According to Suśruta when evidence of the movement of the *sthāniķa vāyu* of *hṛdaya* to *yaktra* (or mouth) is observed then *ardhaśakti* is to be deemed to have been reached.<sup>1</sup>

(2) The appearance of beads of sweat in the axillae, brows (*lalāṭa*) nose, joints of the upper and lower extremities and dryness of mouth.<sup>2</sup>

(3) The appearance of sweat in the regions of brows, nose, joints of the limbs and axillae.<sup>3</sup>

The criteria mentioned above have, the appearance of perspiration in certain parts of the body, as a common feature. Additional points, deserving of consideration are (a) the symptoms (*lakṣana*) of the movement of *hṛdisthita*

1. हृदिस्थानस्थितो वायुयेदा वक्तं प्रपणते ।

व्यायामं कुर्वते जन्तोस्तद्वार्थस्य लक्षणम् ॥ Suśruta : Cikitsā 24 : 47.

2. कक्षा ललाटनासामु इत्पादादिसंचिषु ।

प्रस्त्रेदान्मुखशोषाच बलार्थं तद्विनिर्दिशेत् ॥ Dalhaṇa on above.

3. ललाटदेशे नासायो गात्रसंचिषु कक्षयोः ।

स्वेदः संजायते यस्य बलार्थं तद्विनिर्दिशेत् ॥

Note on *Aśvagahṛdaya* : Sutra 2 : 11.

*vāyu* to the *vaktra* and ( b ) the dryness of the mouth. A point for consideration as regards ( a ) above is the identity of the *hrdisthita vāyu* and the symptoms as may be produced in the *vaktra*. References in available literature to the five *vāyus*, draws attention to *prāṇa vāyu* which has been stated by Caraka<sup>1</sup> as *urahṣṭha* (*hrdaya* is an organ of *uras*). It is correlated to *kaṇṭha*, *fihvā*, *āsyā*, *nāsikā* and functions such as, *śṭhivana* or spitting and *vaktra sañcāraṇa*<sup>2</sup> (*Suśruta*) will exclude *vyāna*<sup>3</sup> and *udāna*<sup>4</sup> which are stated to be *hṛdistha* and *urahṣṭha* respectively. Since only *vaktraśoṣa* has been mentioned as a sign of *ardhaśakti* and not *śvāsa* ( dyspnoea ), which latter is correlated to *ativyāyāma*<sup>5</sup> i.e., exercise, much in excess of *ardhaśakti*, *śvāsa* as a symptom of *ardhaśakti* is to be excluded. Thus, the criterion of *ardhaśakti*, in an individual, who is strong and well nourished with viscous fatty foods, in the cooler season of the year can be summed up as follows—

( 1 ) Appearance of beads of perspiration on brows, nose, axillae and joints of the extremities.

( 2 ) Dryness of the mouth. These highly individualised criteria of *ardhaśakti* are for the present study explained in the following terms—"The sympathetic and parasympathetic branches of autonomic nervous system are locked up in a continuous tug of war to maintain homeostatic state and are influenced by oxygen debt and hormonal responses. The stimulation of the sweat glands of the cranial, cervical and thoracic regions by the post-ganglionic adrenergic fibres of the sympathetic system at the exact stage-point when, in the perpetual automotive tug-of-war, the equilibrium begins to crack up. As this point of the commencement of autonomic

1. स्थानं प्राणस्य मूर्धोःकण्ठजिङ्गास्यनासिकाः ।

द्वीवनक्षवशूद्धरासाहारादि कर्म च ॥ *Caraka : Cikitsa* 28 : 6.

2. योर्वायु वक्त्रसंचारी स प्राणे नाम देहधृक् । *Suśruta : Nidāna* 1 : 13.

3. व्यानो हृदिस्थितः कृत्स्नदेहचारी महाजवः । *Aṣṭāṅgahṛdaya : Sutra* 12 : 6.

4. उदानस्य पुनः स्थानं नाम्युरः कण्ठ एव च । *Caraka : Cikitsa* 28 : 7.

5. क्षयतृणारुचिच्छदिरक्षपित्तअमङ्गमाः ।

कासशोषज्वरशासाः अतिव्याच्यामसंभवाः ॥ *Suśruta : Cikitsa* 24 : 49.

disequilibrium will always represent a particular stage of fatigue in every human being in relation to his basal, nervous and other reserves irrespective of temperament, constitution etc., and this sweat symptom in every case heralds the onset of this stage point.<sup>1</sup>

*Uṣmā Parīkṣā*—The production of *uṣmā* or heat in the body is directly related to the following factors.

(a) The activities of *pācakāṁśas* in the *dhātus*, specially in the *māṁsadhātu* which represents the more active structural constituent of the body. Entering as it does into the structure of the *hrdaya*, *dhamanī sirās*, *snāyus*, *kandarās* and *māṁsa-peśis* etc. which participate in all kinds of movements viz., the movement of blood from *hrdaya* to *dhamanīs*, from *dhamanīs* to *phuphusa* and back, from *hrdaya* throughout the whole body through *dhamanīs* and *sirās* and back all depending upon the property of *māṁsa dhātu* to contract and relax alternatively and the *māṁsa peśis*, *snāyu*, *kandarā* and such other structures, which possess *apratighāta śakti* and perform such functions like *bhāraharaṇa gamanāgamana* and so on.

(b) The *indhana*, derived from *āhāra dravyas* under the influence of *pācakāgni* and subsequently processed by *bhūtāgni* and *dhātvyagni*.

(c) *Tejolvaṇa vāyu* of the external environment representing *vijātiyatejas*<sup>2</sup> (oxygen).

1. G. B. Satyavati *et. al.* The concept of physical exercise in Āyurveda and Modern Physiology. Journal of the Government College of Indian Medicine : Mysore Vol. I, No. 1 pages 91-92.

2. *Nyāyabodhinī* has visualised different species of *tejas*. The combination of *vijātiya tejas* with a substance leading to a change in the physical and chemical characteristic of the latter, has been described as *vijātiya teja samyoga* ( पाको नाम विजातीयतेजः संयोगः, स च नानाजातीयः ). The oxygen of the air as has been shown by modern biochemistry, combines with substances to produce oxidation or burning. This can be cited as an example of *vijātiya tejaḥsamyoga*. Since, all oxidative process, which take

It is the *dahana* of *indhana* by *pācakāgni*, present in *dhātus* that is responsible for the production of *uṣmā*.

Even during rest, the burning of *indhana* and the heat generation goes on as a part of life process, although the heat, thus generated, may be less than the amount produced when a man is active. No doubt, the amount of heat produced, on account of the activities of *dhātus*, specially of *māṁsa dhātus* must be considerable but the *mātrā* of *uṣmā*, produced in normal state, represents the degraded portion of energy, conserved to the extent required to subserve the needs of normal biological activities of the body. The surplus is eliminated through various channels and in special through *sveda* under the influence of *samāna* which latter, it may be noted, is also, held responsible for regulating the work of

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place, in the body, in course of metabolism, need oxygen, specially in the case of aerobic reactions, which produce energy and heat. Oxygen which exhibits *nikṣaya* properties has to be treated as predominately *agneya* in nature. Even otherwise, according to the *dārśanika* and *āyurvedika* schools of thought *tejas* is derived from *vāyu* and *agni* in its turn, from *akāsa*. Therefore, *tejas*, is stated to combine in it, the physical properties of both *vāyu* and *akāsa* in addition to its own. All these *dravyas* specially *vāyu* and *agni* perform *utkṣepana* or *ardhagamana*. Proceeding on this basis that oxygen which is gaseous or *vijātavya* in nature is a *pāneahautika* substance in which *vāyu* and *agni* are the more dominant factors. On account of its *agneya* property, it is able to participate in various kinds of *pūkas*.

It is also, significant to note that according to *Sāṅgadharā*, *vāyu* is transported through *rasadhātu* to all other *dhātus* of the body and nourishes them.

शिरापमन्दो नाभिरस्याः सर्वी व्याप्त्य स्थितां तनुम् ।

पुष्पग्निं त्वनिदं वायोः संयोगात्सर्वधातुमिः ॥

*Sāṅgadharā : Pūrakhaṇḍa 5 : 47.*

Oxygen fulfils the requirements of *vāyu* and it is also treated by modern bio-chemistry as nutrient substance.

*pācaka* in the *koṣṭha*.<sup>1</sup> In the final analysis *bala*, which is to be determined by *vyāyāmaśakti* has to be considered from (1) the amount of energy produced to enable the performance of *vyāyāma*, (2) the amount of heat generated in the process and (3) the capacity of the body to dissipate the surplus of heat within a reasonable time.

Thus, the method adopted by the author for the determination of *mātrā* of *ūṣmā* by prescribing *vyāyāma* to the normal volunteers and patients is meant to furnish information relating to—

- (1) The amount of *ūṣmā* produced in consequence.
- (2) The time taken by the body to develop this amount of *ūṣmā*.
- (3) The time taken by the body to regain its normal *ūṣmā*.
- (4) Increase in *nādi*vega (pulse rate).
- (5) The rate of *śvāsa*.

The *prakṛta* *ūṣmā* in a *svastha* is taken for the purpose of this investigation as 98.4 F, in the *Kakṣā* (by keeping thermometer for three minutes), *nādi* at 72 per minute and *śvāsa-prasvāsa* at 18 per minute.

*The procedure adopted for the examination of  
vyāyāmaśakti and ūṣmotpatti.*

The temperature, pulse, and respiration of both volunteers and patients were taken (1) before retiring to bed in the previous night, (2) early in the following morning, while they are still in bed, after the night's rest (sleep), (3) before commencing *vyāyāma* (in the morning after visiting latrine and washing teeth), running slowly a measured distance, (4) when the signs of *ardhaśakti* appear, (5) thereafter, every 10 minutes, till the pulse, temperature and respiration returned to normal.

1. स्वेददोषाम्बुद्धाहोनि स्रोतांसि समधितिः ।

अन्तरग्नेश्च पार्ष्वस्थः समानोऽग्निवलप्रदः ॥ *Caraka: Cikitsā* 28 : 8.

## PROCEDURE ADOPTED FOR AGNIBALA PARIKṢĀ

The subjects chosen for *agnibala parikṣā* were patients admitted in the hospital, attached to the Post Graduate Training Centre in Āyurveda, for the treatment of various diseases. *Agnibala parikṣā* is carried out, as a routine, in every case admitted, specially in the wards of the professor of *Kāyacikitsā*. Patients suffering from active diseases or stages of diseases as the *āmāvasthā* of *jvara*, *atisāra* etc. were not taken up for this examination.

These patients were kept for three days from the date of their admission, under observation. During this time no active treatments were given to them. They were placed on a diet which was *sātmya* to them. The *mala* voided by them during the previous twenty four hours were collected, measured and studied with reference to the following points :

- ( 1 ) Time number and quantity of motions.
- ( 2 ) *Ākṛti* or appearance of the stool.
- ( 3 ) *Samhatatva* or consistency of the stool.
- ( 4 ) *Varṇa* or colour of the stool.
- ( 5 ) *Gandha* or smell of the stool.
- ( 6 ) *Jalaparikṣā* or examination by water.
- ( 7 ) Others.

## TIME NUMBER AND QUANTITY OF MOTION

The time of the voiding of motion with a view to study the preponderance or otherwise of *doṣas* in the stool as described in related books was found necessary. Incidentally the quantity voided in each time was noted. In the Āyurvedic view, thus, *kapha* is stated to be dominant in the morning, *pitta* in the mid day and *vāta* in the evening. The *mala* voided in the morning by a *grahāṇi* *rogin* ( patient suffering from sprue ) and such other conditions have a bearing on the *malaparikṣā* specially of the morning specimen.

A normal man is stated to void stools twice a day—morning and evening, even though his occupation and habits are factors which may influence the timing. For conditions of India, where large population are vegetarians, two motions

a day is apparently normal. This is in keeping with the āyurvedic description that the passing of two motions a day indicates good health. *Prakṛti* or temperament of an individual is also seen to be considered. Thus, a person whose *prakṛti* is paitika is stated to pass stool for number of times,<sup>1</sup> where as in the case of a person belonging to *vāta prakṛti*, it is considered to be less. In an abnormal state of health as in *atisāra* and *pravāhikā*, the quantity and number of motions may be increased. In these cases *jātharāgni* is stated to be impaired with the production of *āma*.

It will be seen from the foregoing, that the *puriṣa*, its quality, quantity and number of time, it is voided has a direct bearing on the state of *koṣṭha*.

#### ĀKRITI OR APPEARANCE OF THE STOOL

This relates to the form in which *śakṛt* is voided. Normal *śakṛt* should be well formed and resemble a ripe banana fruit or in other words, it must be cylindrical in shape. Such an appearance is suggestive of the integrity of the passage as well as the consistency of the stool. When the consistency of the stool is liquid we can not expect any definite shape. When the passage is obstructed by any growth or spasm of the colon, then also, there will be impairment of the shape ( vide table in Page No. 190 ). The function *pīṇḍikarāṇa* of stool has been attributed to the *pakvāśaya*. In fact the food residue along with some excretions from the large intestine get a definite cylindrical form due to the pressure of the wall of the colon during peristalsis. This peristalsis in its turn, is regulated by the condition of the *agnyādhiṣṭhāna* i.e. *grahaṇī* ( small intestine ).

Thus the appearance of the stool is indicative of the condition of the colon as well as *jātharāgni*.

#### SAṂHATATVA OR CONSISTENCY

The consistency of normal stool resembles that of butter summer time i.e. semiliquid. It varies in different individ-

1. ....प्रभूतसृष्टेदमूत्रपुरीषाश्च..... | *Caraka : Vimāna* 8 : 97.

duals according to their habitates and food, they consume. In people with irregular habits of defecation, the stool remains in the colon for a long time and more *dravaśoṣaṇa* takes place from it to make it dry. On the other hand, in *atisāra*, due to violent peristalsis absorption of water is hampered and in consequence of the motion is liquid. In some conditions, in which the mucus membrane of the intestine is inflamed, there is more exudation of fluid from blood which makes the stool liquid. Again, in some conditions where there is the presence of toxic irritant material,—physical, chemical or bacterial more water is exudated from the intestinal blood vessels to make them liquified, and evacuated as in bacillary dysentery and cholera etc.

Persons taking much vegetable leave a large quantity of undigested cellulose material to be eliminated through the bowel which makes the consistency of the stool semiliquid. But when non-vegetarian meals are taken much of it is absorbed leaving a small amount of residue which is hard. The habit of taking large quantity of water may cause liquidity of the stool.

In *vātaduṣṭi*, the consistency of stool has been described as *śuṣka*, *tanu*, *vijjala*, in *pitta duṣṭi* it becomes *drava* and in *kapha duṣṭi*, it becomes *tantumāt*.

Thus, from the consistency of the stool, the functional states of *jātharāgni* as well as, *dhātavagni* can be studied and described.

#### VARUNA OR COLOUR OF PURĪṢA

Colour of normal *puriṣa* varies from light to dark brown. As mentioned previously in page 37 *varṇa* or colour of the stool is caused by *malarañjaka pitta* ( stercobilinogen ). Melanin, which is excreted from the bowel wall or synthesised from the amino-acid-tyrosin, chlorophyll which is taken with vegetables and iron, copper etc. may also influence the colour of the normal faeces.

Pathologically, conditions of the bowel, like haemorrhage of the upper gastro-intestinal tract ( black colour ), obstruc-

tion to the passage of bile (clay colour), inflammation of the mucus membrane of the tract as in *āntrika sannipāta jvara* or typhoid fever (*canakayuśābha* or pea soup colour) also, influence the colour of the stool.

*Vāta*, vitiates the stool to produce *kṛṣṇa* (black), *śyāva* (grayish blue) or *aruna* (redish) colours, *pitta* produces *nila* (blue), *pīta* (yellow), *rakta* (red) or *kṛṣṇa* (black) colours and *kapha* produces *śveta* (white) colour.

Thus, the colour of the stool is the index of local (gastro-intestinal) as well as general conditions of the body.

#### GANDHA OR SMELL

Smell furnishes information relating the function of *pakvāśaya*. No doubt, as stated elsewhere, the *gandha* of *śakṛt* may vary according to the diet taken. Local conditions like more putrefaction, gangrene of the colon, cancer of small or large intestine etc., may give rise to particular kinds of smells. These diseases are also, related to *āma* at the level of *dhātavagni* or *dhātavagni māndya* as it is also, called. Putrefaction, though a normal event becomes more active when there is more of undigested protein material in the colon which in its turn is correlated to *jāṭharāgni māndya*.

Thus, the smell of *puriṣa*, has reference to some of the functions of *jāṭharāgni*.

#### JALAPARIKṢĀ

This test, carried out in lines, described in *samhitā granthas* by giving of small quantity of the specimen to a cup of clean tap water and the following points are noted :

- (1) Whether it floats or sinks.
- (2) Whether it is *avasādi*<sup>1</sup> (sinks and dissolves) or *vipluta*<sup>2</sup> (floats and spread). The interpretation of the observation made by *jalaparikṣā* are on the lines furnished hereunder—

1. अवसादीति भूमौ पतितं लीनं भवति ।

Cakrapāṇi on Caraka : Cikitsā 19 : 5.

2. विप्लुतमिति प्रसरणशीलम् । Ibid.

(1) If the specimen floats, it is to be inferred that *āhāra pacana* and *drava śoṣana* have satisfactorily taken place in the *adho-āmāśaya* and *pakvāśaya* respectively. The functional state of the *adho-āmāśaya* and *pakvāśaya* are also inferred from this *parikṣā*. An exception to this rule is whether the motion is watery or scybalous, very cold or mixed with mucus (*ślesmā*).<sup>1</sup> In fact that these exceptions relate to intense *āmadoṣa* will be obvious even without *agnibala parikṣā*.

(2) *Avasāditva* or *viplutatva* are indicative of *vātātisāra*.

#### OTHER FACTORS

Additional informations relating to the presence of *āma* (mucus), *kṛmis* (worms) and undigested food particles are, also to be noted. They furnish information as regards the functional states of *agnis*.

#### SIGNS AND SYMPTOMS RELATING TO THE STATES OF AGNI

Signs and symptoms of digestion or its impairment in the *urdhva āmāśaya* *adho-āmāśaya* and *pakvāśaya* are to be noted and interpreted on the basis of data, recorded in the table in pages 192-193.

In the course of this work, the author was able to examine about 38 patients for *agnibala parikṣā* and 13 cases of normal volunteers and 4 cases of patients for *vyāyāma śakti* and *ūṣmotpādana*. Table in Appendix III furnishes information relating to the cases studied so far. Graphs relating to *bala parikṣā* and *ūṣmotpādana* are also furnished in the appendix.

Details relating to the study of diseases due to the affection of different *dhātus* by *āma* formed by the impairment of *dhātuvagni* *vyāpūra* are furnished in table of page 288 to 217. These relate to various kinds of metabolic disturbances, the most marked feature of which being various degrees of fatigue states.

1. मज्जत्यामागुरुत्वादिद्रूपक्वा तूष्णवते जले ।

विनातिद्रवसंबंधत् शैत्यश्लेष्मप्रदूषणात् ॥ *Caraka : Cikitsā* 15 ; 94.

DISEASES DUE TO THE AFFECTION OF DIFFERENT DHĀTUS.<sup>1</sup>

Dhātu	Diseases
<i>Rasa</i>	<i>Aśraddhā</i> (Anoroxia), <i>Aruci</i> (Distaste), <i>Āsyavairasya</i> ( Bad taste in mouth ), <i>Arasajñatā</i> ( Aguesia ), <i>Hṛllāsa</i> ( Nausea ), <i>Gaurava</i> ( Heaviness ), <i>Tandrā</i> ( Drowsiness ), <i>Āngamarda</i> ( Body-ache ), <i>Jvara</i> ( Fever ), <i>Tamas</i> ( Faintness ), <i>Pāṇḍutva</i> ( Pallor ) <i>Srotorodha</i> ( obstruction to channels ) <i>Klaibya</i> ( Impotency ), <i>Sāda</i> (Asthenia), <i>Kṛśāṅgatā</i> (wasting of the body ) <i>Agnināśa</i> ( Loss of the capacity of digestion ), <i>Ayathākālavali</i> ( Premature formation of wrinkles ), <i>Ayathākāla palita</i> ( premature graying of hair ).
<i>Rakta</i>	<i>Kuṣṭha</i> ( skin diseases ), <i>Visarpa</i> ( Erysipelas ) <i>Pīḍakā</i> ( Pimples ), <i>Raktapitta</i> ( Haemorrhage through different channels of the body ), <i>Asrgdara</i> ( Menorrhagia ), <i>Medhrapāka</i> ( Pudentitis ), <i>Āsyapāka</i> ( Stomatitis ), <i>Plihā</i> ( Enlargement of spleen ), <i>Gulma</i> ( Fantum tumous ), <i>Vidradhi</i> ( Abscess ), <i>Nilikā</i> ( Blue mole ), <i>Kāmalā</i> ( Jaundice ), <i>Vyaṅga</i> ( Freckless ), <i>Piplu</i> ( Port wine marks ), <i>Tilakālaka</i> ( Black mole ), <i>Dadru</i> ( Ring worm ), <i>Carmandala</i> ( A type of skin disease ), <i>Śvitra</i> ( Leucoderma ), <i>Pāmā</i> ( Scabies ), <i>Koṭha</i> ( Rashes ), <i>Asramandala</i> ( Red circular patchas ).
<i>Māṁsa</i>	<i>Adhimāṁsa</i> ( Granuloma ), <i>Arbuda</i> ( Tumour ), <i>Kila</i> ( Warts ), <i>Galaśāluka</i> ( A disease of the oropharynx ), <i>Galaśunḍika</i> ( Tonsilitis ), <i>Pūtimāṁsa</i> (Gangrene), <i>Alajī</i> ( A type of skin disease ), <i>Gaṇḍa</i> ( Goitre ), <i>Gaṇḍamāla</i> ( Cervical adenitis ), <i>Upajihvikā</i> ( Uvulitis ).

1. ( A ) *Caraka : Sūtra* : 28 : 8-22.( B ) *Caraka : Nidāna* 4 : 47.

Dhātu	Diseases
<i>Medas</i>	<i>Keśa jaṭilibhāva</i> ( Matting of hair ), <i>Āsyamādhurya</i> ( Sweet taste of mouth ), <i>Karapādadāha</i> ( Burning sensation in hands and feet ), <i>Mukhaśoṣa</i> ( Dryness of mouth ), <i>Tāluśoṣa</i> ( Dryness of palate ), <i>Kaṇṭhaśoṣa</i> ( Dryness of throat ), <i>Pipāsā</i> ( Thirst ), <i>Ālasya</i> ( Idleness ), <i>Kāyamala</i> ( Increased excrements of the body ), <i>Kāyachidra-ūpadeha</i> ( Increased discharge in the orifices of the body ), <i>Aṅgadāha</i> ( Burning sensation in the body ), <i>Aṅgasuptatā</i> ( Numbness in the body ).
<i>Asthī</i>	<i>Adhyasthi</i> ( Hypertrophy of bone ), <i>Adhidanta</i> ( Hypertrophy of teeth ), <i>Dantabhedā</i> ( Pain in teeth ), <i>Dantaśūla</i> ( Colicky pain in teeth ), <i>Asthībheda</i> ( Pain in bones ), <i>Asthīśūla</i> ( Colicky pain in bones ), <i>Vivarṇatā</i> ( Pallor ), <i>Keśaloma &amp; smaśru-doṣa</i> ( Pathological conditions of hairs ), <i>Nakhadoṣa</i> ( Pathological conditions of nails ),
<i>Majjā</i>	<i>Parvaruk</i> ( Pain in finger joints ), <i>Bhrama</i> ( Giddiness ), <i>Mūrchā</i> ( Fainting ), <i>Tamas</i> ( Faintness ), <i>Sthūlamūla parvaja aruṁśikā</i> ( Deep seated abscess of the joints of finger ),
<i>Sukra</i>	<i>Klaibya</i> ( Sterility ), <i>Aharṣaṇa</i> ( Impotency ), <i>Rogiprajanana</i> ( Begets diseased offspring ), <i>Klība prajanana</i> ( Begets impotent offspring ), <i>Alpāyu prajanana</i> ( Begets short lived child ), <i>Virūpa prajanana</i> ( Begets deformed offspring ),
<i>Snāyu, Sirā Stambha</i> , and <i>Kaṇḍarā Khalī</i>	<i>Samkoca</i> ( Contraction ), <i>Granthi</i> ( Tumour ), <i>Sphurāṇa</i> ( Tremour ), <i>Supti</i> ( Numbness ).

SYMPTOMS OF VITIATION OF DHĀTUS BY DIFFERENT DOṢAS.<sup>1</sup>

Dhātus	Symptoms due to vāta duṣṭi	Symptoms due to pittaduṣṭi	Symptoms due to kaphaduṣṭi
1. <i>Rasa</i> ( <i>Tvak</i> )	<p><i>Rūkṣatvaka</i> ( Rough skin )</p> <p><i>Sphuṭita tvak</i> ( Broken skin )</p> <p><i>Supta tvak</i> ( Numbness of skin )</p> <p><i>Kṛṣṇa</i> ( Thin )</p> <p><i>Kṛṣṇa</i> ( Black )</p> <p><i>Tudana</i> ( Pain )</p> <p><i>Ātanana</i> ( Stretching )</p> <p><i>Sarāga</i> ( Redish )</p> <p><i>Parvaruk</i> ( Pain in finger joints )</p> <p><i>Vaivaran্যa</i> ( Discolorisation )</p> <p><i>Sphurana</i> ( Tremouring )</p>	<p><i>Visphoṭaka</i> ( Vesicles )</p> <p><i>Masurikā</i> ( Measles )</p>	<p><i>Stambha</i> ( Inactivity )</p>
2. <i>Rakta</i>	<p><i>Sampāpa</i> ( Feverish )</p> <p><i>Tivraruk</i> ( Excessive pain )</p> <p><i>Vaivaran্যa</i> ( Discolorisation )</p> <p><i>Kṛṣatā</i> ( Thinness )</p> <p><i>Aruci</i> ( Distaste )</p> <p><i>Gātra Arūniṣi</i> ( Pimples in the body )</p> <p><i>Bhukta stambha</i> ( Inactivity of the body after taking meals )</p>	<p><i>Visarpa</i> ( Erysipelas )</p> <p><i>Daha</i> ( Burning Sensation )</p>	<p><i>Pāṇḍvāmaya</i> ( Anaemia )</p>
3. <i>Māṃsa</i>	<p><i>Gurbaṅga</i> ( Heaviness of the body )</p> <p><i>Atyarthā tudana</i> ( Excessive pain in the body )</p> <p><i>Dandāhatavat vedanā</i> ( Pain like beating with a staff )</p>	<p><i>Māṃsavakothana</i> ( Suppuration muscles )</p>	<p><i>Arvuda</i> ( Tumours like lipomaetic )</p>

1. *Falhaṇa* or *Suśrute*: *uttaratantra* 66 : 10.

Dhātus	Symptoms due to Vātaduṣṭi	Symptoms due to pittaduṣṭi	Symptoms due to kaphaduṣṭi
4. <i>Medas</i>	<i>Muṣṭihatavat-vedanā</i> ( Pain like beating with fist. )		
	<i>Atyarthā Śramita</i> (Ex- cessive exhaustion )		
	<i>Saṣṭula granthi</i> (Pain- ful tumour )		
5. <i>Asthī</i>	Like those of <i>māṁsa</i> and <i>Mandaruk- granthi</i> ( Tumours having less pain )	<i>Granthi</i> ( Tum- ours )	<i>Ādracarmavān- addhābhagā- tratā</i> ( Feeling of being cov- ered with a wet skin )
	<i>Avraṇagranthi</i> ( Tu- mour without any ulceration )	<i>Sveda</i> ( Swea- ting ) <i>Bhr̥satṛṭ</i> ( Ex- cessive thirst ) <i>Bhr̥ṣa vamana</i> ( Excessive vomiting )	<i>Tvak gaurava</i> ( Heaviness in the skin )
6. <i>Majjā</i>	<i>Asthibheda</i> ( Break bone pain )	<i>Asthidāha</i> (Bur- ning sensation in bones )	<i>Sthūlatā</i> (Fatty- ness )
	<i>Parvabhedā</i> ( Break- bone pain in joints )	<i>Hāridranakha</i> (Yellow nails)	<i>Meha</i> ( Uri- nary diseases.)
	<i>Sandhi śūla</i> ( Pain in joints )		<i>Asthistambha(?)</i>
	<i>Māṁsakṣaya</i> ( Was- ting of muscle )		
	<i>Balakṣaya</i> ( Weak- ness )		
7. <i>Śukra</i>	<i>Asvapna</i> ( Sleepless- ness )		
	<i>Santataruk</i> ( Conti- nued pain )		
	<i>Asthīśoṣa</i> ( Wasting of the bone )		
	Like those of <i>asthī</i> and <i>Aprāśaamaruk</i> (Continuous pain)	<i>Hāridranetra</i> ( Yellow eye )	<i>Śukla netra</i> ( White eye )
	<i>Kṣipra śukra muñ- cana</i> ( Rapid eja- culation of semen )	<i>Pūtiśukra</i> ( Putrified se- men )	<i>Śukra sañcaya</i> (Retention of the semen )
	<i>Kṣipra śukra vandhana</i> ( Speedy stoppage of semen )	<i>Pitāvabhāṣa</i> <i>Śukra</i> (Yellow- ish semen )	
	<i>Garbha Kṣipra Muñ- cana &amp; Bandhana.</i>		

SYMPTOMS DESCRIBED IN MODERN MEDICINE IN DISEASES  
OF GASTRO INTESTINAL TRACT.<sup>1</sup>

A. *In diseases of ūrdhva-āmāśaya*

1. Bad taste in mouth ( *Āsyā vairasya* )
2. Dryness of mouth ( *Mukhaśuṣkata* )
3. Halitosis ( *Pūtigandhi niḥśvāsa* )
4. Nausea ( *Utkleśa* )
5. Vomiting ( *Chardi* )
6. Thirst ( *Tṛṣṇā* )
7. Increased appetite ( *Kṣut* )
8. Flatulence in the upper abdomen ( *Udara ūrdhva bhāga  
ādhmāna* )
9. Heart burn ( *Hṛt dāha* )
10. Acid eructation ( *Amlodgāra* )
11. Hic cough ( *Hikkā* )
12. Water brash ( *Lālā praseka* )
13. Anoroxia ( *Anannābhilāsa* )
14. Perverted appetite ( *Kṣut vai paritya* )
15. General malaise ( *Āngamarda* )
16. A sense of ill health ( *Asvāsthya* )
17. Incapacity for work ( *Ālasya* )
18. Dark rim beneath the eye ( *Aksikūṭa kṛṣṇatā* )
19. Sallow or earthy complexion ( *Pāṇḍutā* )
20. Emaciation ( *Dhātukṣaya* )
21. Palpitation ( *Hṛt dravatva* )
22. Dyspnoea ( *Śvāsakṛcchra* )
23. Pre-cardiac pain ( *Hṛdaya vyathā* )
24. Syncope ( *Mūrcha-sannyāsa* )
25. Vertigo ( *Bhrāma* )
26. Headache ( *Śirah śūla* )
27. Depression of spirit ( *Dainya* )
28. Neurasthenia ( *Daurbalya* )
29. Irritability of temper
30. Drowsiness ( *Tandrā* )
31. Coated tongue ( *Jihvā upadeha* )
32. Disturbed sleep ( *Nidrā-ghāta* )

1. These symptoms are collected from different diseases of the Gastro intestinal tract from :

- A. Beaumont : Medicine
- B. Savill's system of clinical medicine
- C. Loewenberg : Medical Diagnosis 6th Edition
- D. Price Medicine

33. Urticaria ( *Śitapitta* )
34. Fullness of stomach ( *Udara gaurava* )
35. Paroxysm ( Desire for unusual food )
36. Diarrhoea ( *Atisāra* )
37. Constipation ( *Viṣṭambha* )
38. Urinary change ( *Mūṭra parīvartana* )
39. Skin change ( *Tvak-Varṇa-parīvartana* )

B. *In diseases of adho āmāśaya & pakvāśaya*

1. Diarrhoea ( *Atisāra* )
2. Tenesmus ( *Pravāhaṇa* )
3. Constipation ( *Vīrandha* )
4. Flatulence ( *Ādhmāna* )
5. Pain ( *Vedanā* )
6. Tenderness ( *Sparśasaha* )
7. Prostration ( *Dainya* )
8. Vomiting ( *Vamana* )
9. Collapse ( *Moha-sannyāsa* )
10. Subnormal temperature ( *Śīta-fyara* )
11. Wasting ( *Kṣaya* )
12. Pyrexia ( *Jvara* )
13. Exhaustion ( *Śrama* )
14. Profuse haemorrhage ( *Atiraktasrāva* )
15. Anaemia ( *Pāṇḍu* )
16. Nausea ( *Utkleśa* )
17. Headache ( *Śirahśūla* )
18. Colicky pain ( *Śūla* )
19. Cheeks flushed ( *Gaṇḍa rāgatva* )
20. Dry tongue ( *Śuṣka Jihvā* )
21. Coated tongue ( *Jihvā upadeha* )
22. Thirst ( *Pipāsā* )
23. Mental confusion ( *Moha* )
24. Cramps ( *Ākṣepa* )
25. Thready pulse ( *Sūtravat nāḍi* )
26. Fatigue ( *Śrama* )
27. Asthenia ( *Daurbalya* )
28. Oedema of feet ( *Padadeśaśotha* )
29. Newritis ( *Vedanā* )
30. Sleeplessness ( *Nidrānāśa* )
31. Urticaria ( *Śitapitta* )
32. Embarrassed breathing ( *Śvāsakṛchra* )

CHARACTERISTICS OF STOOL IN DIFFERENT DISEASES  
DESCRIBED IN MODERN MEDICAL SCIENCE.<sup>1</sup>

Characteristics of the stool	Disease
Offensive	Acute catarrhal infantile diarrhoea Epidemic ( Summer ) infantile diarrhoea Acute ulcerative colitis Bacillary dysentery
Purulent	" " ( in last stage )
Odourless	Acute catarrhal infantile diarrhoea
Yellow	" " "
Green	Acute ulcerative colitis
Black	Gastro-duodenal ulcer and cancer
Red ( Blood )	Acute ulcerative colitis Bacillary dysentery Amoebic dysentery, Malarial dysentery Kala azar dysentery, Schistosomal dysentery and Oesophago stomatic dysentery
Pale colour	Sprue
Colourless	Asiatic cholera
With mucus	Infantile epidemic diarrhoea
( <i>Ama</i> or <i>ślesmā</i> )	Enterocolitis Acute ulcerative colitis Bacillary dysentery-gelatinous, mucus Schistosomal dysentery Cholera ( flakes of columnar epithelium ) Muco-colitis-Mucus passed in masses and cast of several inches long Amoebic dysentery-Brownish mucus Balantidial dysentery-Gelatinous mucus
Slimy	Acute catarrhal infantile diarrhoea, Enterocolitis
Large quantity	Sprue, Amoebic dysentery
Frothy	Sprue, Enterocolitis
Consistency liquid	Cholera ( Opaque rice watery ) Epidemic infantile diarrhoea, Schistosomal dysentery & Others
Consistency semi solid	Amoebic dysentery etc.
Consistency hard	Schistosomal dysentery
Frequency more	Cholera, Bacillary dysentery and others
Morning	Sprue

1. Collected from Savill's System of Clinical Medicine, Symptoms in Diagnosis by Jonathan Campbell Meakings, 1948 Edition and Loewenberg : Medical Diagnosis, 6th Edition.

CHARACTERISTICS OF VOMIT IN DIFFERENT DISEASES  
AS DESCRIBED IN MODERN MEDICAL SCIENCE.<sup>1</sup>

Characteristics of the vomit	Disease or condition for it
<b>A. General appearance</b>	
1. With mucus	
2. Colouring matter	
3. Saliva	Chronic gastritis etc.,
4. Acids	
5. Foreign bodies	
6. Food ( half digested )	
<b>B. Consistency</b>	
1. Watery	Alcoholic debauch, Chronic gastritis
2. Acidic	Hyper-chlorhydria, Acid fermentation, Peptic ulcer, Gastric crisis of Lebes, Hysteria, Migraine
3. Rice watery	Cholera
4. Semi solid	Sea sickness, Vertigo
5. Thick tena- cious mucus vomiting	Acute or chronic gastritis
<b>C. Colour</b>	
1. Green	Patulous pylorus
2. Yellow	" "
3. Grass Green	Intestinal obstruction
4. Yellow, black, blue, red	Due to different kinds of food and drinks
5. Red	( a ) Swallowing of blood as in haemorrhage from mouth i. e. lips, gums, tongue, tonsils, after or during epistaxis.

1. Collected from

( a ) Savill's System of Clinical Medicine, 13th Edition.

( b ) Loewenberg : Medical Diagnosis : 6th Edition.

( c ) Symptoms in Diagnosis by Jonathan Combell Meakings,  
6th Edition.

Characteristics of the vomit	Disease or condition for it
	( b ) Blood diseases-Purpura, Haemophilia, Seury, Severe secondary or primary anaemia, Leukaemia, Haemolytic jaundice, Cholemia, Hodgkin's disease.
	( c ) Acute fevers like Severe malaria, Typhus, Epidemic influenza, Relapsing fever, Yellow fever, Small pox, Dengu, Chronic nephritis Well's disease, Portal obstruction, Atrophic cirrhosis, Yellow atrophy of liver, Passive congestion of liver, Mitral stenosis.
	( d ) Vicarious menstruation
	( e ) Haematemesis may also occur in Acute pancreatitis, Appendicitis, Cholecystitis, Mesenteric embolism and thrombosis.
	( f ) Gestic origin, like Gastric ulcer, Duodenal ulcer, Gastric carcinoma, (Coffee ground) Miliary aneuysm and varicosis of the stomach and oesophagns, Injury to epigastric area, Poisons like Arsenic and Mercury
<b>D. Contents</b>	
1. Fecal vomit	Intestinal obstruction, Peritonitis, Gastro intestinal fistula
2. Pus	Pharyngeal abscess, Peritonsillar abscess, "Oesophagial abscess,
	Splenic or perirenal abscess
3. Phlegm ( <i>Ślesmā</i> )	Phlegmonous gastritis Diphtheric inflammation of the stomach

CHARACTERISTIC OF PAIN IN DIFFERENT DISEASES OF ABDOMEN AS DESCRIBED IN MODERN MEDICAL SCIENCE.<sup>1</sup>

Characteristics of the pain	Diseases or conditions for it
A. Acute pain sharp lancinating or stabbing pain	Peritonitis
B. Pressing, aching, agonising pain	Diseases of Gall bladder, Intestinal obstruction, Pancreatitis, Perforated ulcer of the stomach
C. Throbbing pain	Any inflammation or suppuration of the digestive tract
D. Colicky Gripping pain	Cholera mobus, Asiatic Cholera, Biliary colic, Renal-colic, Intestinal obstruction, Pancreatitis, Strangulated hernia, Appendicitis
E. Grinding or gnawing pain	Carinoma of the viscera
F. Dull pain	Inflammation of the mucus membrane
G. With distension	Nervous dyspepsia
H. With burning sensation	Hyper-chlorohydria
I. Relation to food	
I. Just after food	Nervous dyspepsia, Acute and chronic gastritis Simple or malignant ulcer
II. An hour after food	Excessive acidity due to hyper-secretion or fermentation
III. Not related with food	Nervous dyspepsia and carcinoma of the stomach

1. Collected from

( a ) Savill's System of Clinical Medicine

( b ) Loewenberg : Medical Diagnosis, 6th Edition

( c ) Symptoms in Diagnosis by Jonathan Campbell Meakings, 6th Edition

SYMPTOMS IN DIFFERENT DISEASES RELATING TO KOSHĀ  
ACCORDING TO MODERN MEDICAL SCIENCE. <sup>1</sup>

Symptoms	Diseases or conditions
<i>A. Indigestion or Avipaka</i>	Diseases of Liver, Gallbladder, Appendix, Bowel, Pancreas, Heart, Lungs, Brain, Sinuses, Eyes, Nose, Throat, Thyroid, Kidneys and other disease like Anaemia, Fevers, Septicemia, Helminthiasis, Chronic Intoxication, Diabetes. Tebes dorsalis, Neurasthenia, Hysteria and Pregnancy
<i>B. Appetite</i>	
1. Excessive	Diabetes mellitus, Hypo-pituitarism
2. Loss of appetite	Chronic Gastro-intestinal disease, Fever, Anoroxia nervosa
3. Aversion to certain kinds of foods	Achlorhydria, Hysteria, Pregnancy
<i>C. Heart burn</i>	Hyper-acidity due to acute and chronic gastritis, Gastric ulcer, Duodenal ulcer, Gastrectasis, Cholecystitis, Spastic and ulcerative colitis, Vagotonia, Achlorhydria
<i>D. Nausea</i>	
1. Psychic	Seeing revolting sights, smelling nauseating odours, listening to grave or boring tales
2. Reflex.	Eye strain, Diseases of the middle ear, Migraine, Sea sickness, Car sickness, Intestinal worms, Ovarian diseases, Pregnancy
3. Nervous cause	Hysteria, Neurasthenia, Psychoasthenia

1. Collected from

( a ) Savill's System of Clinical Medicine, 13th Edition

( b ) Loewenberg : Medical Diagnosis, 6th Edition

( c ) Jonathan Campbell Meakings : Symptoms in Diagnosis, 6th Edition

Symptoms	Diseases or conditions
4. Gasto intestinal Causes	<p>Cholecystitis, Duodenitis, Achlorhydria</p> <p>Chronic gastritis, Acute gastritis, Carcinoma of the stomach, Pyloric obstruction, Gastrectasis, Cirrhosis of liver, Cotitis, Constipation, Toxic gastritis</p>
5. Toxic causes	<p>Eating greasy or spoiled food, over eating, Ureamia, Pregnancy, Hyper-digitalisation</p> <p>Other diseases are Pellagra Diabetes mellitus Acidocis, Acute Pancreatitis, Acute nephritis, Pulmonary tuberculosis, Exophthalmic goiter, Addisons disease. Chronic myocarditis, Mitral stenosis</p>
E. Eruption (Water brash)	<p>Oesophagitis, Stricture or obstruction of the oesophagus, oesophageal, diverticulum</p> <p>Gastric ulcer, Gastric dilatation</p>
F. Vomiting ( Acute )	<p>Sea sickness, car sickness, after general anaesthetics, certain types of food ingestions, emetic drugs like apo-morphin, ipecac, Copper sulphate, Zinc sulphate, Antimony etc. in psychic shock, Fright, undue Excitement, Anxiety, Disgust</p>
( Chronic )	<p>Acute appendicitis, Acute intestinal obstruction, Incarcerated hernia, Acute peritonitis, Acute gastritis, Acute Gastro-enteritis, Migraine, Cholecystitis, Cholelithiasis, Nephrolithiasis, Acute Brights disease, Ureamia, Acute alcoholism, Hyperdigitalisation and after administration of Morphine</p> <p>Fracture of skull, Cerebral embolism, Sinus thrombosis, Yellow fever, Acute yellow atrophy of liver and Acute hepatic degeneration</p> <p>I. Stomach. Carcinoma, Ulcer, Achylia gastrica, Pyloric stenosis of infancy, Gastrectasis, Chronic gastritis, Pylorospasm, Ulceration of the oesophagus, Hourglass contraction of the stomach, Syphilis or Tuberculosis of the stomach</p>

Symptoms	Diseases or conditions
	<p><b>II. Intestines.</b> Chronic intestinal obstruction, Carcinoma of the colon, Carcinoma of the small intestine, Dysentery, Ulcerative colitis, Ulceration of the intestine, Paralytic ileus, Diverticulitis, Regional ilitis, Intestinal worms, Pancreatitis, Pancreatic cyst, Adenoma of the islands of Langerhans</p>
	<p><b>III. Liver.</b> Cirrhosis of the liver, Amyloid liver, Bantis disease, Carcinoma of the liver, Carcinoma of the bile duct, Carcinoma of the Gallbladder, Abscess of the liver and Passive congestion of the liver</p>
	<p>(B) <i>Diseases of Nervous system</i></p>
	<p>Cerebral tumour, Cerebral abscess, Hydrocephalus, Cerebral haemorrhage, Cerebral syphilis, Loco Motor, ataxia, Pachy meningitis, Pituitary cachexia, Hysteria, Psychosthenia, Nurasthenia</p>
	<p>(C) <i>Diseases of endocrine system</i>, Exophthalmic goitre, Myxodema, Addison's disease</p>
	<p>(D) <i>Diseases of the cardio-vascular system</i> Congestive heart failure, Chronic myocarditis, Coronary thrombosis, Aneurysm of the abdominal aorta, Mitral stenosis</p>
	<p>(E) <i>Diseases of the haemopoetic system</i> :— Purpura, Primary and severe secondary anaemia, Sickle cell anaemia, Leukaemia</p>
	<p>(F) <i>Reflex causes</i> :—Eye strain, Pertusis, Angioneurotic oedema, Allergic reactions, Prostetis</p>
	<p>(G) <i>Toxic causes</i>—Chronic glomerular nephritis, Nephro sclerosis, Chronic nephrosis, Pregnancy, Chronic alcoholism, Vitamin deficiencies</p>
G. Diarrhoea	Food and drug poisoning. Enterocolitis,
Acute.	Iritis, Cholera morbus, Asiatic cholera, Bacillary dysentery, Acute amoebic dysentery, Sprue, Pallegra, Typhoid fever, Influenza, Mesenteric thrombosis, Vit 'B' and 'D' deficiencies

Symptoms	Diseases or conditions
	Chronic enterocolitis, Ulcerative colitis, Mucus-colitis Tuberculus enteritis, Sprue, Coeliac disease, Carcinoma of the pancreas, Chronic amoebic dysentery, Nervous diarrhoea and some other parasitic infections
H. Constipation.	Bad stool habit, improper diet, Insufficient liquid intake, Sedentary habit
	In diseases like Intestinal obstruction, Strangulated hernia, Neoplasms, Strictures, Mucus colitis, Paralytic, Iritis, Fecal impaction
	Lead poisoning, Opium poisoning, Visceroptosis, Haemorrhoids, Fissures in anus, Fistulae in anus
	Some other gastro-intestinal, hepatic gall bladder and nervous diseases and Anaemia
I. Abdominal pain (Generalised)	Generalised peritonitis, Acute haemorrhagic pancreatitis, Ruptured gastric ulcer, Mesenteric thrombosis, Acute gastro enteritis, Acute enterocolitis, Acute intestinal obstruction, Tumour of large intestine, Tumours of small intestinal food poisoning, ulcerative colitis, Mucus colitis, spastic colitis, Amoebic dysentery, Bacillary dysentery, Lead, Arsenic, Mercury, and other metal poisoning, Tebes dorsalis, Addison's disease, Exophthalmic goitre, Asiatic cholera, Achylia gastrica, Abdominal aneurysm, Tuberculosis, Peritonitis, Torsion of an ovarian cyst, Abdominal neoplasm
	Occasionally in Appendicitis, Regional ileitis, Retro peritoneal malignancy, Chronic constipation, Allergic dyspepsia, Intestinal worms

Symptoms	Diseases or conditions
II. Epigastric Pain	Hyper acidity, Gastric ulcer, Duodenal ulcer, Acute or chronic gastritis, perforated gastric or duodenal ulcer, Acute haemorrhagic pancreatitis, Chronic pancreatitis, Cholecystitis, Cholelithiasis, Nephrolithiasis, Abdominal angina, Tabes dorsalis, Omental hernia, Abdominal aneurysm, Retroperitoneal malignancy, Diaphragmatic hernia
III. Pain in the right hypochondrium	Cholelithiasis, Cholecystitis, Subphrenic abscess, Diseases of liver such as Carcinoma, Cyst, Abscess, Cirrhosis, and Active or Passive congestion, Carcinoma of the hepatic flexures
IV. Pain in the left hypochondrium	Diaphragmatic hernia, Splenic infarction, Splenomegally, Rupture of spleen, obstruction of the bowel, Carcinoma of the splenic flexure, Mucus colitis, Spastic colon
V. Pain in the right loin	Referred pain by Cholecystitis and Cholelithiasis
VI. Pain in the left loin	Nephrolithiasis, Hydronephrosis, Pyonephrosis, Pyelitis, Nephritis, Tuberculous-Kidney, Polycystic kidney Abscess and cyst of kidney and adrenals
VII. Pain in iliac region.	As in right side
VIII. Pain in the hypogastric region	Acute appendicitis, Acute salpingitis, Ruptured ectopic gestation, Ovarian cyst, Inguinal hernia, Acute diverticulitis, Acute pyelitis, Psoas abscess, Ulcerative colitis, Tuberculosis of caecum, Cacinoma of the colon, Fecal impaction, Regional ilitis, Typhoid fever
IX. Pain in rectum	Retention of urine, Disease of ureter, bladder, uterus, Pelvic cellulitis, Constipation, Tumour and Cancer etc.
	Ischeo-rectal abscess, Haemorrhoids, fissures, Ulceration, Stenosis, Carcinoma polyp

Symptoms	Diseases or conditions
<i>J. Bad Taste in Mouth</i> ( <i>Āsyā vairasya</i> )	
<i>K. Dryness of lips and mouth</i> ( <i>Mukha Oṣṭha śoṣa</i> )	Gastric disorders
<i>L. Hallitosis</i> ( <i>Pūtīgandhi Śvāsa</i> )	
<i>M. Thirst</i>	Dyspepsia, Acute dilatation of the stomach, Inflammation of Stomach, Vomiting
<i>N. Flatulence</i>	
<i>I. Gastric</i>	Chronic gastritis, Gall bladder dyspepsia, Nervous individuals
<i>II. Intestinal</i>	Fermentation of starch and sugar, constipation, Diarrhoea, Paralytic Ilius, Coeliac disease Sprue
<i>O. Hic cough</i>	<ol style="list-style-type: none"> <li>I. Reflex stimuli of phrenic nerve by gastric or colonic flatulence or by irritant food</li> <li>II. Irritation of the peritoneum-local or general—Typhoid</li> <li>III. Nervous hysteria</li> </ol>
<i>P. Water brash</i> ( <i>Praseka</i> )	Irritation of stomach, Dyspepsia, Peptic ulcer
<i>Q. Anoroxia</i> ( <i>Anannābhilāsa</i> )	
<i>R. Tenesmus</i> ( <i>Pravāhaṇa</i> )	<ol style="list-style-type: none"> <li>I. Various conditions of the anus like Pruritis, Eczema, Fissure or Piles</li> <li>II. Rectal conditions like Carcinoma, Proctitis, Stricture etc.</li> <li>III. Hysterical and Nervous subjects</li> <li>IV. Other causes of diarrhoea as mentioned above.</li> </ol>

## DISCUSSION

The concept of *agni* is seen to be based on earlier Śāṅkhya and *Nyāya-vaiśeṣika* concept of *tejas*. Āyurveda, while benefiting by these contributions, is seen to have modified them in the context of the process of life. The difference between *darśanika* and *āyurvedic* views, in this regard is comparable to the science of physics (including Chemistry) in its pure aspect and bio-chemistry which is an applied aspect of the former science. But in general, the basic concept of *agni* is the same for both the pure and applied schools of sciences. The science of Āyurveda, which is basically the science of life or biology has seen in digestive and metabolic processes the manifestation of *tejas* or *agni*. Various biological substances present in the body which perform actions similar to *agni* have been classed under the heading or implicit in the concept of *pitta*.

In addition to the five kinds of *pittas* which have special functions to perform, Āyurveda has described seven species of *dhātvagnis* and five species of *bhūtagnis*. The former are seen to relate to substances, which are necessary for what is described as *dhātvagni vyāpāra*, and the latter to the principle present in each molecule of organic substances which are utilised for the digestion of the molecule itself in anaerobic type of reactions. Substances included under *dhātvagni* are seen to be represented by group specific and reaction specific enzymes. The latter was shown to represent the oxygen present in the structure of the molecule itself. This oxygen has been designated as *sajūtiya tejas*, whereas molecular oxygen derived from the atmospheric air required for aerobic reactions as *vijātiya tejas* the two terms being drawn from *Nyāyabodhī* commentary on Annambhaṭṭa's *Tarkasamgraha*. Of the five *pittas*, described in Āyurveda, the importance of *pācakapitta* was brought out and its correlation to tissue metabolism was shown inviting, incidentally, attention to the role of cathepsins in anaerobic and catabolic processes. *Jāṭharāgnipāka* corresponding to gastro-intestinal digestion, in all its different aspects was discussed at some length. The process of digestion, as described in *Samhitā granthas*

was critically studied and reoriented and brought upto date indicating the digestive events that take place in different parts of the *kōṣṭha* or gastro-intestinal tract. The concept of *vipāka* was also examined at some length in this connection. The implication of digestive events, that occur in the *pakvāśaya*, including the part, it plays as *vātasthāna* was sought to be explained in the light of data contributed by modern researches in biochemistry and micro-biology.

Likewise *dhātavagnipūka*, corresponding to intermediary metabolism was explained drawing material therefor, from the available original Āyurvedic classics and important commentaries thereon. The nature of intermediary metabolites *prasāda* or *poṣaka dhātus* and *kittā* or waste products and their utilisation or disposal as the case may be was discussed and reoriented. The mode of production of *dehatusmā* or body heat was examined, vis-a-vis, *pūcakāṁśas*, *vijātīya tejas*, and *indhana* represented by oxygen and nutrition respectively. (1) *Jāṭharāgni* and *dhātavagni vyāpāra*, in view of *agnibala* and (2) *vyāyāmaśakti* and *Uṣmotpatti* in view of *māṁsabala nirṇaya* were studied in a number of normal subjects as well as patients admitted to the Hospital attached to the Post Graduate Training Centre, Jamnagar. The data gathered from (1) and (2) above were then studied together with a view to correlate *agnibala*, *māṁsabala* and *Uṣmotpatti*. It has to be noted here that *bala nirṇaya* referred to above does not cover *vyādhi kṣamatva*, as this aspect of *bala* forms a subject by itself, it has not been attempted in this thesis.

#### *Bala-vyāyāmaśakti and production of Uṣmā*

The data collected from the study of *vyāyāmaśakti* in normal subjects and patients in wards, led to the following highly suggestive conclusions.

(1) In six normal volunteers of age ranging from 22 to 25 years, it was seen that the time of reaching *ardhaśakti* ranged between 15 to 20 minutes having regard to the appearance of sweat on the forehead, axillae and joints of upper and lower limbs and corresponding temperature, pulse, and respiration rates—an average of 16.5 minutes. The time

taken for the temperature, pulse and respiration to reach back to normal ranged between 30 to 45 minutes, the average being 41.5 minutes. The ratio of the time taken to reach *ardhaśakti*, *vis-a-vis* an increase in the temperature, pulse and respiratory rates and their return to normal is seen to be on an average 2 : 5.

(2) In three normal volunteers of age ranging between 22 and 25 years the time of reaching *ardhaśakti* ranged between 7 to 10 minutes, having regard to the appearance of sweat in the fore-head, axillae and joints of limbs and the corresponding increase in their pulse, temperature and respiratory rates on an average of 8 minutes. The time taken for the temperature, pulse and respiration to return to normal ranged between 35 to 105 minutes—the average being 65 minutes. The ratio of the time taken to reach *ardhaśakti* and to return to normal is seen to be on an average 1 : 4.

(3) In another group of three normal volunteers of age ranging between 22 and 25 years the time of reaching *ardhaśakti* was 5 minutes in each case having regard to the appearance of sweat in fore-head, axillae and joints of limbs, corresponding to an increase in pulse, temperature and respiration rates. The time taken for the temperature, pulse and respiration to return back to normal ranged between 130 to 150 minutes, the average being 138 minutes. The ratio of the time taken to reach *ardhaśakti* and return to normal is seen to be on an average 1 : 27.

Figures presented above, though obtained from a small number of normal volunteers were still sufficient to provide hypothetical criteria for the determination of *pravara*, *madhya* and *avara* types of *bala* which can be summed up thus :

(i) *Pravara bala*—The return of temperature, pulse and respiratory rates to normal should be about  $2\frac{1}{2}$  times, the time taken by the subject to reach his *ardhaśakti* (corresponding temperature pulse and respiratory rates).

(ii) *Madhyabala*—The return of temperature, pulse and respiratory rates to normal should be about four times the time taken by the subject to reach his *ardhaśakti* (corresponding temperature, pulse and respiratory rates).

( iii ) *Avarabala*—The return of temperature, pulse and respiratory rates to normal is about 27 times the time taken by the subject to reach his *ardhaśakti* ( corresponding temperature, pulse and respiratory rates ).

*Note*—It is of course understood that these figures relate to *snigdhabhojins* who are exercised in the morning of late *Śiśira*. These figures in *rūkṣa bhojins* may possibly vary even in *śitakāla* and more so in *uṣṇakāla*. This hypothetical formula of three grades of *balas* can be studied in a much larger number of normal persons belonging to different age groups.

This study was extended in the first instance to three patients admitted to the Hospital attached to Post Graduate Training Centre in Āyurveda, Jamnagar. It elicited the data as shown in the Table at page 176.

The *bala* of these three patients, judged from the point of view of *pravara bala* may have to be treated as *avara bala*. As regards their *agnibala*, it was found that in all the three cases, it was *manda*.

*Summing up*—Proceeding on the basis of the material available in the Āyurvedic classics, it was possible to provide a fairly dependable clinical method for determining *agnibala* by *jarāṇaśakti*, and *māṁsa bala* and *ūṣmotpatti* from the point of view of *vyāyamaśakti*. As regards the former, normal and abnormal states of functioning of *agni* in different parts of the *mahāsrotas* and clinical symptoms relating to them have been furnished. As regards the latter, note has been taken of the *hṛdaya*, which is the *mūla* of *rasavaha* and *prāṇavaha srotas* and the *mūla dhāmanis, srotas, māṁsa, sīrā, kandarā*, all of which have *māṁsa* as a common structural factor. In judging *sūrṣra bala*, as reflected by *pravara* type of *vyāyamaśakti* which signifies the integrity of the entire organism, *hṛdaya* is correlated to *phuphusa* through *rasa-rakta*, and to *māṁsa dhātu* every where in the body through *sīrās* ( vessels ) which in their turn, also contain *māṁsa dhātu* in their structure. The *rasa* and *rakta* transporting *poṣakadravyas* including *vāyu* to the *sthāyi māṁsa dhātus*, among others, the *pācakāṁsa* in the *sthāyi dhātu* representing in-

trinsic *agni* of this *dhātu*, *sajātiya tejas* *amśas* present in the *poṣaka dhātus*, combining with *vijātiya tejas* transported by *rasa* and *rakta* causes *pāka*, *dahana* and *tapana*, resulting in the production of *karmaśakti* (energy) on the one hand, and *kitṭa* (waste products like  $CO_2$ ,  $H_2O$  etc.) on the other. At the level of *ardhaśakti*, the production of *kitṭamīśa* having reached a point where the available *vijātiya tejas* is inadequate to digest them, leads to increased functioning of *hrdaya* and *prāṇavaha śrotas* as reflected in an increased rate of *hṛt-spandana* (heart rate) *ucchvāsa-niḥśvāsa* (respiration) and *ūṣmotpādana* (temperature). These lastly mentioned factors, at the level of *ardhaśakti* and the corresponding time taken by any individual to reach this point, studied together with the rapidity with which these three factors return to their *prākṛta* level, constitute a fairly reliable index for assessing the *mārīsa bala* and *agnibala* in any given individual.

*Conclusion*—The author does not claim to have covered or exhausted the entire subject, considering the time and facilities he could command. None the less, he believes to have initiated a new mode of approach to some of the basic aspects of *Āyurveda* which may have to be continued in many directions not only by the future post graduates, but also by other workers interested in this subject, elsewhere in the country.



Name	Age	Disease	Duration of disease	Time taken to reach ardhāśakti	Time taken to come to normal	Ratio
1. Ranchoda	21 yrs	Ātatvabhi-niveśa	2 months	3½ minutes	50 minutes	1:14
2. Babu Samji	14 yrs	Kṣudraśvāsa	1 year	9 minutes	135 minutes	1:15
3. Premji Hamid	17 yrs	Kṣudraśvāsa	2 months	15 minutes	130 minutes	1:8

## SECTION V

## APPENDIX-I

Analysis of symptoms of diseases of Koṣṭha—classified in relation to different functional parts of mahāsrotas.

Disease	Symptoms relating to <i>urdhva-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Grahanī</i>	<i>Bhukte</i>	<i>Hṛt dāha</i> + *Burning sensation in the praecardium)	<i>Hṛllāsa</i> (Nausea)	*Due to <i>Kapha vṛddhi</i>	<i>Agnimāndya</i> ( Impaired digestion)	<i>Ajīrṇa śar-ana</i> ( Voiding of undigested food in the motion)	<i>Duhkha pacana</i> (Retarded digestion)		<i>Uru ruk</i> (Pain-thighs)	<i>Nīlābha śarāṇa</i> (Voiding blueish stool)	<i>Bhīna mala</i> (Broken faeces)		<i>Kanthaśoṣa</i> (Dryness in the throat)
	<i>Svāsthya</i> (A sense of ease after taking meals)		<i>Chardi</i> (Emesis)	†Due to upward pressure of the distended stomach	<i>Śukta pāka</i> ( Production of Organic acids due to fermentation)				<i>Vāṅkṣaṇa ruk</i> (Pain-groins)	<i>Pitābha śarāṇa</i> (Voiding yellowish stool )	<i>Āmasaṁśṭa</i> (Mixed with undigested material )		<i>Āsyāśoṣa</i> (Dryness in mouth)
	<i>Śvasa</i> + (Dyspnoea)	<i>Pūṭ ud</i> ÷ <i>gāra</i> - (foul smelling eructation)	<i>Duṣṭa</i> <i>Udgāra</i> (Foul smelling eructation )		<i>Kṣut</i> (Appetite)				<i>Ādhmāna</i> (Flatulence) at the end of digestion	<i>Pūṭimala śarāṇa</i> (Voiding of purified stool)	<i>Ślesma samsṛṣṭa</i> (Mixed with mucus)		<i>Sarvarasa gṛdhhi</i> (Desire for substances having all rasas or tastes)
	<i>Tiktodgāra</i> (Eruption having bitter-taste)	<i>Amla ud-gāra</i> (Acid-eructation)	<i>Madhura</i> <i>Udgāra</i> (Sweet eructation)	+ Referred burning sensation ÷ Due to putrifaction	<i>Trṣṇā</i> (Thirst)	<i>Pārśvaruk</i> (Pain in Flanks)			<i>Cirāt mala</i> <i>śarāṇa</i> (Delayed voiding)		<i>Sañcayāt upayesanam</i> (Voiding of large collected mass of stool)		<i>Kanthatadāha</i> (Burning sensation in the throat)
					<i>Parikartikā</i> (Sawing pain)				<i>Duhkha śarāṇa</i> (Voiding faeces with pain)		<i>Vistambha</i> (Constipation)		<i>Aruci</i> ( Distaste )
									<i>Drava mala</i> (voiding liquid motion)				<i>Tṛṭ</i> ( Thirst )
									<i>Śuska mala</i> (Dry Stool)				<i>Āsyopadeha</i> (Coating in the mouth)
									<i>Tanumala</i> (Loose motion)				<i>Āsyā mādhurya</i> (A sensation of sweet taste in the mouth)
									<i>Āma mala</i> (Undigested stool)				<i>Sthivana</i> (Spitting of saliva)
									<i>Śabdavat mala</i> (Noisy motion)				<i>Vairasya</i> (Bad-taste)
									<i>Phenavat mala</i> (Frothy stool)				
									<i>Muhur-badha</i> <i>Muhur-drava</i> (Sometimes constipation and sometimes loose motion)				

Disease	Symptoms relating to <i>urdhva-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Udara</i>	<i>Dāha</i> (Burning sensation)	<i>Utkleśa</i> (Nausea)	<i>Śvasa*</i> (Dyspnoea)	*Referred	<i>Avipūka</i> (Indigestion)	<i>Dāha</i> (Burning Sensation)	<i>Avipūka</i> (Indigestion)		<i>Udara</i> <i>vipūṭana</i> (Sensation of splitting of the abdomen)	<i>Atisāra</i> (Diarrhoea)	<i>Śuklavareca</i> (White stool)		
									<i>Kukṣi śūla</i> (Colicky pain in the lower abdomen)	<i>Dāha</i> (burning sensation)			
									<i>Udāvarta</i> (Tymphanitis)	<i>Haritavareca</i> (Green stool)			
									<i>Adhogurutva</i> (Heaviness in the lower abdomen)	<i>Hāridra varca</i> (Yellow stool)			
									<i>Vāta-saṅga</i> (Retention of gases)				
									<i>Varcasāṅga</i> (Retention of stool)				
									<i>Āhata-adhmāta</i> <i>dr̥tivat-śabda</i> (Tympanic note on percussion)				
<i>Arśa</i>	<i>Udgāra</i> (Eructation)	—	<i>Hṛllāsa</i> (Nausea)	—	<i>Agni-Vaśamya</i> (Impaired digestion)	—	<i>Agnimāndya</i> (Poor digestion)	—	<i>Kukṣiyathā</i> (Pain in lower abdomen)	<i>Dāha</i> (Burning sensation)	<i>Vāṅkṣaya</i> <i>ānāha</i> (Distension of the lower abdomen)	—	<i>Arocaka</i> (Dis-taste)
	<i>Śvāsa*</i> (Dyspnoea)		<i>Chardi</i> (Emesis)		<i>Antraktūjana</i> (Noise in intestine)				<i>Vāṅkṣaya</i> <i>vyathā</i> (Pain in groin)	<i>Pāka</i> (Proctitis)			<i>Kṣavathu</i> (Sneezing)
	<i>Hṛdgṛaha*</i> (Embarrassment of the chest)		<i>Praseka</i> (Salivation)						<i>Uruvyathā</i> (Pain-things)	<i>Uśmamala</i> (Hot stool)	<i>Pāyuvikarṣi</i> (Sucking of the anus)		<i>Svaropaghāta</i> (Impairment of Voice)
	<i>Hṛdayadrava</i> (Palpitation)		<i>Nisthivikā</i> (Spitting)						<i>Viṣṭambha</i> (Blocking of faeces)	<i>Dravamala</i> (Liquid stool)	<i>Nabhibikarṣi</i> (Sucking of the Umbilicus)		<i>Āsyamūḍhurya</i> (Sensation of sweet taste in mouth.)
	*Referred								<i>Grathitamala</i> (Scybala)	<i>Nilamala</i> (Blue stool)	<i>Vastivikarṣi</i> (Sucking of the bladder)		
									<i>Pita mala</i> (Yellow stool)	<i>Skandamala</i> (Scanty faeces)	<i>Pitamala</i> (Fat like stool)		
									<i>Śuklamala</i> (Red stool)	<i>Uḍāvarta</i> (Fat like stool)			

Disease	Symptoms relating to <i>Urdhva-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Śula</i>	<i>Hṛtśūla*</i> (Colicky pain in Pre-cardium)	—	<i>Hṛllāsa</i> (Nausea)	—	<i>Nābhideśa dāha</i> (Burning sensation in umbilical region)	—	—	—	<i>Trikaśūla</i> (Colicky pain in the lumbar region)	—	—	—	<i>Aruci</i> (Distaste)
	<i>Pārśvaśūla</i> (Colicky pain in flanks)		<i>Praseka</i> (Salivation)		<i>Vidahakāla Kopano</i> (Aggravates during digestion)				<i>Bastiśūla</i> (Colicky pain in the bladder)				
	<i>Pr̥ṣṭhaśūla</i> (Colicky pain in backside)		<i>Āmāśayaruk</i> (Pain in stomach)						<i>Jirñe kopah</i> (Aggravation after digestion)				
	<i>Śvāsakṛcchara</i> (Dyspnoea)		<i>Stimita koṣṭha</i> (Low peristaltic movement in the gastro-intestinal tract)						<i>Vit stambha</i> (retention of faeces)				
	*Referred pain		<i>Bhukte ruk</i> (Pain after digestion)						<i>Vātastambha</i> (Retention of gases)				
									<i>Vāta puriṣa kṛcchra</i> (Painful voiding of stool)				

Disease	Symptoms relating to <i>Urdhva-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	Vāta	Pitta	Kapha	Remarks	Vāta	Pitta	Kapha	Remarks	Vāta	Pitta	Kapha	Remarks	
<i>Parināma Śūla</i>	—	—	<i>Chardi</i> (Emesis)	—	—	<i>Dāha</i> (Burning sensation)	—	—	<i>Ādhmāna</i> (Flatulence)	—	—	—	—
			<i>Hṛällāśa</i> (Nausea)						<i>Ānāha</i> (Painful distension of abdomen with sound)				
<i>Atisūra</i>	—	—	<i>Utkleśa</i> (Nausea)	—	—	<i>Avipāka</i> (Indigestion)	—	—	<i>Vātabandha</i> (Retention of faeces)				
									<i>Vijjala puriṣa</i> (Slimy stool)	<i>Pitamala</i> (Yellow stool)	<i>Snigdhamala</i> (Viscous stool)		
									<i>Āmapuriṣa</i> (Undigested stool)	<i>Haritmala</i> (Green stool)	<i>Śvetamala</i> (Whitestool)		
									<i>Viplutapuriṣa</i> (Stool which spreads and floats)	<i>Nilamala</i> (Blue stool)	<i>picchilamala</i> (Slimy stool)		
									<i>Ayasādipuriṣa</i> (Stool which sinks and disloves in water)	<i>Kṛṣṇamala</i> (Black stool)	<i>Tantumatmala</i> (Stool having thready appearance)		
									<i>Raktamala</i> (Red stool)	<i>Āma mala</i>			
									<i>Rūkṣamala</i> (Rough stool)	<i>Atidurgandhamala</i>	<i>(Stool having undigested food material)</i>		
									<i>Dravamala</i> (Liquid stool)	<i>Gurumala</i>			
									<i>Āmagandhimala</i> (Stool having putrid smell)	<i>Durgandhamala</i>			
									<i>Sarukmala</i> (Voiding with pain)	<i>Ślaṣṭopahita</i> (Mucoid stool)			
									<i>Saśabdamala</i> (Voiding with noise)	<i>Anubandha śūla</i> (Continued colicky pain)			
									<i>Vibandhavāta</i> (Retention of gas)	<i>Alpamala</i> (Less quantity of stool)			
									<i>Frequent motions</i>	<i>Abhikṣṇa mala</i> (Frequent motions)			
										<i>Sapratvāhika mala</i> (Milding with constipation)			

Disease	Symptoms relating to <i>Urdhva-āmāsaya</i>				Symptoms relating to <i>Adha-āmāsaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms	
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks		
<i>Gulma</i>	<i>Hṛdruk*</i> (Prae-cardial pain)	<i>Pipāsā</i> (Thirst)	<i>Hṛllāsa</i> (Sensation of vomiting or nausea)	—	<i>Pārśva ruk</i> (Pain in flanks)	<i>Jiryatiśūla</i> (Pain during digestion)	—	—	<i>Vitsaṅga</i> (Retention of feces)	<i>Vidāha</i> (Burning sensation)	—	—	<i>Galaśoṣa</i> (Dryness in the throat)	
	<i>Amsaruk*</i> (Pain in shoulder)	<i>Vidāha</i> (Burning Sensation)	<i>Gaurava</i> (Heaviness)		<i>Antravikujana</i> (Gurgling sound in the intestine)	<i>Vidāha</i> (Burning sensation)			<i>Vātasanga</i> (Retention of Gas)	<i>Vitabhedā</i> (Diarrhoea)			<i>Vaktraśoṣa</i> (Dryness in mouth)	
	<i>Bhukte mr-dutva</i> (Pain relieved after taking meals)		<i>Alparuk</i> (Less pain)		<i>Visamāgnī</i> (Imbalanced digestion)	<i>Apakti</i> (No digestion)			<i>Kukṣiruk</i> (Pain in the lower abdomen)				<i>Aruci</i> (Distaste)	
	<i>Urdhva Vāta</i> (Reverse peristalsis)		<i>Udgāra-bāhulya</i> (Excessive eructation)		<i>Āhāra-Vidāha</i> (Burning sensation by ingestion of food)				<i>Jirñe prakopa</i> (Aggravation of the attack at the end of digestion)				<i>Trpti</i> (Satisfaction)	
	<i>Kṛcchraśvāsa</i> (Dyspnoea)		<i>Chardi</i> (Emesis)						<i>Ātopa</i> (Distension with sound)				<i>Katuvaktratā</i> (Sensation of acrid taste)	
	*Referred pain								<i>Ānāha</i> (Flatulence)				<i>Praseka</i> (Salivation)	
<i>Amlapitta</i>	<i>Tiktodgāra</i> (Bitter eructation)	<i>Hṛd dāha*</i> (Burning sensation in praecardial region)	<i>Hṛllāsa</i> (Nausea with palpitation)	—	<i>Avipūka</i> (Indigestion)	—	—	—	Aggravation after digestion	—	—	—	<i>Aruci</i> (Distaste)	
		Vomiting of green, yellow, blue, black and red coloured material, sour in taste and like water of flesh wash	Vomiting of transparent slimy material mixed with mucus		Aggravation during digestion					Passes motion of different types				<i>Tṛṭi</i> (Thirst)
	<i>Amlodgāra</i> (Acid eructation)													

Disease	Symptoms relating to <i>Urdhva-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Chardi</i>	<i>Hṛtpiḍa</i> (Prae-cardiac pain)	<i>Pitavamana</i> (Yellow vomit)	<i>Kapha praseka</i> (Salivation)	—	—	<i>Avipaka</i> (Indigestion)	—	—	Aggravation of symptoms after digestion	—	—	—	<i>Mukhāśosa</i> (Dryness of mouth)
	<i>Pārśvapiḍa</i> (Pain in flanks)	<i>Uṣṇavamana</i> (Hot vomit)	<i>Snigdhavamana</i> (Viscous vomiting)										<i>Svarabheda</i> (Change in voice)
	<i>Sarvadāprabala udgāra</i> (Eruption with great sound)	<i>Harit</i>	<i>Ghana vamana</i> (Thick vomit)										<i>Āsyā mādhurya</i> (Sweet taste in mouth)
	<i>Saphena</i>	<i>yamana</i>	<i>Svādu vamana</i> (Sweet vomiting)										<i>Aruci</i> (Distaste)
	<i>Chardi</i> (Frothy vomiting)	<i>Tiktavamana</i> (Bitter vomit)	<i>Alpa ruk</i> (Slight pain)										
	<i>Vicchinna</i>	<i>Dhūmra</i>	<i>Śukla vamana</i> (White vomiting)										
	<i>chardi</i> (Vomiting of spilted material)	<i>vamana</i> (Vomiting like substances)	<i>Śīta vamana</i> (Cold vomiting)										
	<i>Kṛṣṇa</i>	<i>Sarakta</i>	<i>Kaphanīta</i> vamana										
	<i>chardi</i> (Coffee ground vomiting)	<i>vamana</i> (Blood vomiting)	<i>vamana</i> (Mucoid vomiting)										
	<i>Tanuka</i>	<i>Kṣōrodaka-</i>	<i>Tantumāt</i> vamana										
	<i>chardi</i> (Thin vomit)	<i>nibha vamana</i>	<i>vamana</i> (Thready vomiting)										
	<i>Kaṣaya</i>		<i>Hṛllāsa</i> (Nausea)										
	<i>chardi</i> (Astringent vomiting)												
	<i>Kṛcchreṇa</i>												
	<i>chardi</i> (Painful vomiting)												
	<i>Alpa chardi</i> (Vomiting in small quantity)												

## APPENDIX-II

Table Showing the Result of Agni Bala Parikṣā ( Jaṭharāgni ) of Patients

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Dura- tion	Agni bala		Parikṣā.		Pakvāsaya vyāpāra.			
								Urdhva āmūsaya vyāpāra	Adha-āmūsaya vyāpāra	Amla pāka	Pacana kriyā	Sāra kīṭṭa vibhājana	Rasa- śoṣāṇa	Pīḍī Karāṇa	Drava- śoṣāṇa
								Madhura pāka	10	11	12	13	14	15	
1	2	3	4	5	6	7	8	N.A.D.	N.A.D.	Manda ( stool sank in water for all three days )	Impaired	Manda Daurbalya or weakness N.A.D.	Impaired	Impaired	
1. Jamnadas Mohanlal		32	Male	Frequent motion pain, in abdomen, weakness, cough	Commenced from the convalescent period over two months of continuous fever	Paittika Grahanī	4 mns.	N.A.D.	N.A.D.	Manda ( stool sank in water for all three days )	Impaired	Manda Daurbalya or weakness N.A.D.	Impaired	Impaired	
2. Smt. Lochaben Perumal		50	Female	Pain in the back side of the right leg, inability to use the limb; Giddiness	It started with neuralgic pain all over the body	Vātika Gṛdhraśṭ	1½ yrs.	N.A.D.	N.A.D.	Vaiṣamya ( Sometimes mala is sāma & sometimes nirāma )	N.A.D.	weakness N.A.D.	Impaired ( Ajāśa- kṛd-vat stool )	Impaired ( Hard stool )	
3. Smt. Muktaben Prabhu-das		22	Female	Excessive vaginal bleeding even after menstrual period, headache, pain in loins, Giddiness, Pandu	Derangement of the monthly Course with General malaise since last two years.	Rakta Pradara	6 mns.	N.A.D.	N.A.D.	Manda ( Puriṣa sama for all three days )	N.A.D.	N.A.D.	Impaired ( Ajāśa- kṛd-vat mala )	Impaired ( Hard stool )	
4. Thakarji Jetha		45	Male	Pain ( Colicky ) in right lumbar region 2-3 hours after taking meals, Śvāsa, Kāsa, Palpitation, pre-cardiac pain	Started with loss of appetite and loss of memory	Pariṇāma śūla	1½ yrs.	N.A.D.	Impaired ( Sometimes amla udgūra )	Viṣama ( Stool sometimes āma and sometimes nirāma. )	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
5. Dulamji Devji		30	Male	Kāsa, discharge of frothy sputum, pain in the left chest, heart burning, weakness	Having history of Jirna prati- syāya.	Śoṣa	15 dys.	N.A.D.	Impaired ( Heart burn )	Impaired ( Stool-āma for all three days )	N.A.D.	Impaired ( Weakness emacia- tion )	N.A.D.	N.A.D.	
6. Abdul Rahim Hasam		45	Male	Pain in the right hypochondriac region, burning sensation, Kāsa Jvara	Started after excessive vomiting	Śūla ( Vātika- Paittika )	5-6 yrs.	N.A.D.	Impaired ( Burning sensation in stomach and pain )	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
7. Giridharlal Samji		25	Male	Mūtradāha, Pus in urine, Pain in right gluteal region and lower mandibular region, dainya Udarāśūla	These symptoms started after being attacked by a venereal disease )	Phiraṅga- ( Abhyantara )	1 yr.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
8. Ramjibhai		32	Male	Pain in dakaśīnavasit pradeśa no relation with food but aggravated at the end of digestion and weakness	Commenced with viṣambha	Śūla ( Vātika )	3 mns.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	Impaired ( weakness )	N.A.D.	N.A.D.	

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Dura- tion	Agni bala		Parikṣā				Pakvāṣaya Vyāpāra			
								Urdhva āmāsyaya vyāpāra	Madhura Paka	Adha-āmāśaya vyāpāra		Pācana kriyā		Sarakīṭṭa vibhājana	Rasa- śoṣana	Piṇḍi- karāṇa	Drava- śoṣana
								7	8	9	10	11	12	13	14	15	
9. Jayasukhalal Varichand	20	Male	3 4	5	6	Śūla as Upadrava of pravāhika	1½ yrs.	N.A.D.	N.A.D.	Impaired ( Stool āma for all three days )	N.A.D.	Impaired ( Weak- ness )	Impaired	Impaired ( Some- times loose motion sometimes hard mo- tion )			
10. Prabhaben Amritlal	48	Fe- male		Pallor, giddiness, Number of motions more, Inability for hard work, dyspnoea	Started with loose motions	Pāṇḍu ( Vātaja )	3 mns.	N.A.D.	N.A.D.	Viṣma ( Sometimes āma & sometimes nirāma stool )	N.A.D.	Impaired ( Weak- ness )	Impaired	Impaired			
11. Gaffar Kasam	20	Male		Koṣṭhe vāyupūrṇatā, Kaṭīśūla, Uraḥśūla, Ḫṛddrava, Weak- ness, Pain in joints, Sleepless- ness, Madhura udgāra ( Sweet taste of eructation )	Arose after strenuous work	Koṣṭhā-śrita vāta	4 mns.	Impaired ( Sweet eructa- tion )	N.A.D.	Viṣma ( Sometimes āma & sometimes nirāma stool )	N.A.D.	Impaired ( Weak- ness )	N.A.D.	N.A.D.			
12. Yuvansingh Kanauji	40	Male		Kāsa, Śvāsa, Kaphaniṣṭhivana Hṛddravatva constipation & Weakness	Suffered from syphilis earlier	Śīraja Gra-n thi ( Aortic ane- uryism due to syphilis )	5 yrs.	N.A.D.	N.A.D.	N.A.D.	Impaired ( Consti- pation )	Impaired ( Weak- ness )	N.A.D.	N.A.D.			
13. Mansukhlal Mohanlal	24	Male		Weakness, Exhaustion by slight exercise, sleeplessness, loss of appetite	Sukrakṣaya ( At night ) since last year	Dhātukṣaya- ja vāta vṛddhi	6 mns.	N.A.D.	N.A.D.	Impaired ( Stool āma for all three days & Kṣudhā nāśa )	N.A.D.	Impaired ( Weak- ness )	N.A.D.	N.A.D.			
14. Asavi Mahamdia	32	Fe- male		Śvāsa, Kāsa, Jvara, loss of appetite, Debility, pain in bones and joints, Constipation	Started slowly with Kāsa.	Pratamaka śvāsa	1 yr.	N.A.D.	N.A.D.	Viṣama ( Stool some- times sinks in water & sometimes floats )	Impaired ( Consti- pation )	Impaired ( Weak- ness )	N.A.D.	N.A.D.			
15. Lalbahadur Dipbahadur	28	Male		Colicky pain in abdomen, Dry- ness in throat, Pain in chest, Head & lumber region	Developed such symptoms in the convalescence period of Kāmalā	Śūla ( Vātaja )	1 mn.	N.A.D.	N.A.D.	Impaired ( stool āma for all three days )	N.A.D.	N.A.D.	N.A.D.	N.A.D.			
16. Mithabhai	70	Male		Frequent, painful micturition, flatulence, constipation sleep- lessness, giddiness	Started after chronic constipa- tion	Paurusa granthi bṛddhi ( Enlarged prostate )	20 dys.	N.A.D.	N.A.D.	Viṣma ( sometimes Pakvamala & some- times apakva )	Impaired ( Consti- pation )	N.A.D.	N.A.D.	N.A.D.			

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Duration	Agni bala-Parikṣā							
								Urdhva āmāsyaya vyāpāra		Adhā-āmāsyaya vyāpāra		Pākviśaya Vyāpāra			
								Madhura Paka	Amla Paka	Pacana kriyā	Sārakīṭa vibhājana	Rasa śoṣana	Piṇḍi karana	Drava śoṣana	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
17.	Nandlal Kalidas	30	Male	Pallor, stomatitis, Emaciation, weakness, liquid motion 7 to 8 times aday, Lethargy	Started with loose motion gripping pain and mucoid stool	Pāṇḍu Ati- śāra Upa- druta Gālā-Śundhi	6 mns.	N.A.D.	N.A.D.	Impaired (Stool <i>āma</i> for all three days )	Impaired (Diarrhoea )	Impaired (Weakness )	Impaired	Impaired ( Loose motion )	
18.	Pravin- kumar Mohanlal	15	Male	Pain in throat, cough, headache, excessive thirst	After attending local festival in hot sun and taking cold water just after it	Pakṣāghāṭa	3 dys.	N.A.D.	N.A.D.	Impaired ( Mala <i>āma</i> for all three days )	N.A.D.	N.A.D.	Impaired	Impaired ( Semi-liquid motion )	
19.	Maheshwar Rasiklal	15	Male	Unable to use his left upper and lower limb. Having fits at an interval of 15 dys to 2 months	After headache and <i>mūrchā</i>	Pakṣāghāṭa	1½ yrs.	N.A.D.	N.A.D.	<i>Viṣma</i>	N.A.D.	N.A.D.	Impaired	Impaired	
20.	Mansukh- lal Kubarji	11	Male	Unable to move his right upper & lower limb	Started suddenly after fever	Pakṣāghāṭa	2 yrs.	N.A.D.	N.A.D.	Impaired	N.A.D.	N.A.D.	Impaired	Impaired	
21.	Jayantilal	11	Male	Itching and vesicles in the skin. Aggravates in rainy and winter season	Since his infancy	Pāmā	10 yrs.	N.A.D.	N.A.D.	Impaired	N.A.D.	N.A.D.	Impaired	Impaired	
22.	Ibrahim Lakha	48	Male	Śvāsa, cough Headache	After excessive exhaustion	Śvāsa (Kṣu- dra )	2 mns.	N.A.D.	N.A.D.	Impaired (Stool <i>āma</i> for all three days )	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
23.	Somji Pur- ushottam	35	Male	Pratiśyāya, sometimes haemoptysis weakness	After injury to chest	Uraḥ kṣata	18 yrs.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	Impaired	N.A.D.	
24.	Chanduben Bhagabanji	22	Fe- male	Pallor, oedema in feet, dyspnoea after slight exhaustion constipation, <i>Madhura udgāra</i> ( sweet eructation )	She was a patient of <i>Gāṇḍupada</i> Kṛmi and <i>atisāra</i>	Pāṇḍu	2 mns.	Impaired (Madhura Udgāra)	N.A.D.	N.A.D.	Impaired (Constipation)	Impaired (Weakness )	N.A.D.	N.A.D.	
25.	Mansur ali Alibhai	30	Male	Pain in glutial region, constipation	Started after chronic constipation, History of injury in lumber region	Kaṭigatavāṭa (Abhīghāṭa)	6 yrs.	N.A.D.	N.A.D.	<i>Viṣama</i> ( Sometimes <i>pakvamala</i> and sometimes <i>apakva</i> )	Impaired (Constipation)	N.A.D.	N.A.D.	N.A.D.	
26.	Garmaram Ranchoda	21	Male	Loss of appetite, constipation, loss of memory weakness	History of chronic night pollution	Atattvābhini- veśa	2 mns.	N.A.D.	N.A.D.	Impaired	Impaired	Impaired	Impaired	Impaired	
27.	Nandki- shore Bha- gabanji	13	Male	Pain and swelling of joints of fingers, Impairement of the activities of the right arm.	History of <i>Pūyameha</i> and fever for 2 months.	Āmavāṭa (Pūyamehā)	2 mns.	N.A.D.	N.A.D.	Impaired	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
28.	Debali Belji	17	Fe- male	Śvāsa, Kāsa, Pain in chest, Headache, weakness	started after <i>pratiśyāya</i> .	Śvāsa ( Tamaka )	2 yrs.	N.A.D.	N.A.D.	Impaired	Viṣama ( Sometimes constipation & sometimes normal motion )	N.A.D.	Impaired	Viṣama ( Sometimes hard & sometimes liquid )	

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Duration	Agni bala Parikṣā				Pakvāśaya vyāpāra			
								Ūrdhva āmāsyaya vyāpāra	Madhura Pāka	Amla Pōka	Pācana Kriyā	Sarakitta vibhājana	Rasa śoṣana	Piūdi karana	Drava Śoṣana
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
29.	Saunya Anupala	30	Male	Sometimes <i>drava mala</i> , sometimes <i>baddha mala</i> , Pain in abdomen, Weakness, sometimes acid and sometimes sweet eructation, Pallor	Started with <i>Raktajapravāhika</i>	<i>Grahanī</i> ( <i>Pittakaphoja</i> )	9 mns.	Impaired (Sweet eructation)	Impaired (acid eructation)	Impaired (Stool āma for all three days)	Impaired (Some times baddha & sometimes <i>dravamala</i> )	Impaired (Weak- ness)	Viṣama	Viṣama	
30.	Sukurbhai Hasambhai	54	Male	<i>Ādhmāna</i> , <i>udaraśūla</i> , <i>Annavidāha</i> , Acid and sweet <i>utkleśa</i> , sometimes <i>vamana</i> vertigo, Headache, Abdominal pain, aggravation of pain after digestion	Started after chronic constipation, Burning sensation of epigastrum Acid eructation, Nausea, etc.	<i>Gulma</i> ( <i>Vātaja</i> )	2 yrs.	Impaired (Sweet eructation)	Impaired (acid eructation)	Impaired (Stool āma for all three days)	N.A.D.	N.A.D.	Impaired	Impaired	
31.	Navin- chandra Ranchhod- das	23	Male	Rashes over the body stomatitis, constipation, at intervals of 1 to 3 days)	After an attack of Influenza ( <i>ślaiśmika jvara</i> )	<i>Sapitta</i>	4 yrs.	N.A.D.	N.A.D.	N.A.D.	Impaired (constipa- tion)	N.A.D.	N.A.D.	N.A.D.	
32.	Premji Hamid	17	Male	<i>Śvasa</i> (dyspnoea), <i>Bhrama</i> (Giddiness), <i>Sirahśūla</i> (Headache), <i>Dāhamūtra pravītti</i> Burning micturition), <i>Daurbalya</i> (weakness)	Commenced after suffering from <i>Prameha</i> (Gonorhoea)	<i>Kṣudra śvāsa</i>	2 mns.	N.A.D.	N.A.D.	Impaired	N.A.D.	Impaired (Weak- ness)	N.A.D.	N.A.D.	
33.	Babu Samji	14	Male	<i>Kusa</i> , <i>Śvasa</i> , <i>Daurbalya</i>	More in winter season	<i>Kṣudra śvāsa</i>	1 yr.	N.A.D.	N.A.D.	Viṣama	N.A.D.	Impaired (Weak- ness)	N.A.D.	N.A.D.	
34.	J. Krishna	20	Male	Unable to have typing work in left hand due to spasm of fingers at the time of typing	Developed slowly	<i>Vātavyādhī</i> ( <i>Anguligata</i> )	6 mns.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
35.	Rebun- kumari	22	Fe- male	Haemoptysis with cough, Pain in chest	Started bronchitis in her native place—Nepal.	<i>Kṣataja Kasa</i>	4 yrs.	N.A.D.	N.A.D.	Viṣama	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
36.	Kahar Abdulrahim	7	Male	Inability to use left upper and right lower limb, <i>Māṃsaśoṣa</i> (wasting of muscles)	After 14-15 days of continuous fever	<i>Pāngu vāta</i>	6 yrs.	N.A.D.	N.A.D.	Viṣama	N.A.D.	N.A.D.	Impaired	Impaired	
37.	Gangabai Trikam- chand	40	Fe- male	Giddiness, weakness, Exhaustion on slight exercise	Amenorrhea since last 12 years.	<i>Rasa kṣaya</i>	3 mns.	N.A.D.	N.A.D.	Impaired	N.A.D.	Impaired (Weak- ness)	N.A.D.	N.A.D.	
38.	Raghiben Hirabai	30	Fe- male	<i>Udgarabāhulya</i> , Pain in all over the abdomen, Headache, Pain in joints, constipation	Started with <i>Pratiśyāya</i> .	<i>Kṛmi</i> ( <i>Puri- ṣaja</i> )	1½ yrs.	Impaired ( <i>Udgāra</i> )	Impaired ( <i>Udgāra</i> )	N.A.D.	Impaired (constipa- tion)	N.A.D.	Impaired	Impaired	

## APPENDIX-III

## Balapariksha Studied Together with Ushmotpatti

No.	Names	Age	Diet	Agni	Previous night at bed time			Morning rising from bed			Before starting exercise			When attaining ardhaśakti			Time taken to attain ardhaśakti	Time taken for bilitation	Distance covered in exercise	Remarks.
					Pulse P. M.	Temp. (Degrees in far)	Resp. P. M.	Pulse P. M.	Temp. (Degree in far)	Resp. P. M.	Pulse P. M.	Temp. (Degree in far)	Resp. P. M.	Pulse P. M.	Temp. (Degree in far)	Resp. P. M.				
<i>Volunteers</i>																				
1. B. Nanda	22	Non Vegetarian	Sama	76	98.4	18	62	96.4	14	78	97	16	128	98.8	33	5 mns	2 hrs 15 mns	720 ft	Running	
2. Banbiharilal	22	Vegetarian	"	80	98.4	17	73	96.5	13	73	96.5	13	150	96	26	10 "	35 "	—	Jumping	
3. V. S. Awasthi	22	"	"	72	97.2	20	52	96.8	18	60	97	18	132	98.4	34	10 "	34 "	1100 ft	Running	
4. G. C. Jain	23	"	"	72	97	19	52	96.8	19	66	97	23	100	97.6	34	15 "	30 "	—	Kusti	
5. H. S. Kasture	23	"	"	70	99.2	18	68	97	16	68	97	16	137	99.4	33	10 "	55 "	—	"	
6. R. J. Agnihotri	23	"	"	64	96.2	18	64	96	17	64	96.2	17	120	90.8	33	25 "	40 "	—	"	
7. A. P. Pandey	23	"	"	77	97	19	69	96	19	66	97	23	100	97.6	35	15 "	30 "	—	"	
8. D. N. Jha	25	"	"	75	98.4	18	55	98.2	13	52	96.4	16	103	97.7	25	5 "	90 "	660 ft	Running	
9. M. M. Kate	25	"	"	62	96.4	34	78	96.4	34	70	97	26	100	97.4	40	15 "	45 "	—	Kusti	
10. N. B. Sathe	25	"	"	86	97.4	16	85	96.4	16	85	96.4	18	96	97.4	25	15 "	45 "	—	"	
11. B. N. Phadke	25	"	"	80	97.8	19	70	97.4	16	70	97.6	17	122	98.4	30	15 "	45 "	—	"	
12. B. N. Pandey	25	"	"	83	97.6	20	67	96.4	16	67	96.4	18	115	96.4	30	5 "	2½ hrs	—	"	
<i>Patients</i>																				
13. Ranchhoda	22	"	"	72	98	22	57	97.2	18	70	97.4	20	132	103.6	30	5 "	50 mns	1 mile	Running	
14. Babu	14	"	"	60	97.4	26	60	96.4	26	60	96.4	26	102	96.6	32	9 "	2 hrs 15 mns 2 hrs	2700 ft	"	
15. Premji Hamid	17	"	"	55	96.2	29	55	94	26	60	95.5	29	144	97.1	28	15 "	10 mns	3700 ft	"	

# *Indological Truths*

## APPENDIX IV

Malaparikṣā according to Yogaratnākara

### मलपरीक्षा<sup>३</sup>

रुद्रतन्त्रात् :—

वातान्मले तु इवता शुष्कता चापि जायते ।  
 पीतता जायते पित्तात् शुक्रता श्लेष्मतो भवेत् ॥ १ ॥  
 सस्त्रिपाते च सर्वाणि लक्षणानि भवन्ति हि ।  
 त्रुटिं फेनिलं रुचं धूमलं वातकोपतः ।  
 वातश्लेष्मविकारे च जायते कपिशं मलम् ॥ २ ॥  
 बद्धं सुत्रुटिं पीतश्यामं पित्तानिलाद् भवेत् ।  
 पीतश्वेतं श्लेष्मपित्तादीयत्सान्धं च पिच्छुलम् ॥ ३ ॥  
 श्यामं त्रुटिपीतामं बद्धश्वेतं त्रिदोषतः ।  
 दुर्गन्धः शीतलश्वेतं विष्ट्रोत्सर्गो यदा भवेत् ॥ ४ ॥  
 तदाजीर्णमलं वैशैदोषज्ञैर्परिभण्यते ।  
 कपिलं गुटियुक्तं च यदि वचोऽवलोक्यते ॥ ५ ॥  
 प्रचीर्णमलदोषेण दूषिता परिकष्यते ।  
 सितं महत्पूतिगन्धं मलं ज्येयं जलोदरे ॥ ६ ॥  
 श्यामं चयेत्वाभवति पीतं सकटिवेदनम् ।  
 अतिकृष्णं चातिशुभ्रमतिर्पीतं तथाऽरुणम् ।  
 मरणाय मलं किंतु भृशोष्णं सूर्यवे ध्रुवम् ॥ ७ ॥

अन्यच—

वातस्य च मलं कृष्णं ततः पित्तश्य पीतविद् ।  
 रक्तवर्णमलं किंचिन्मलं श्वेतं कफोद्धवम् ॥ ८ ॥  
 आमं वा श्लेष्मजं प्राहुमिथितं द्वन्द्वजं वदेत् ।  
 अपवर्वं स्यादजीर्णं तु पवर्वं स्वच्छ्रमलं भवेत् ॥ ९ ॥  
 अस्यद्वौ पिण्डितं शुष्कं मन्दामौ तु द्रवीकृतम् ।  
 दुर्गन्धं चन्द्रिकायुक्तमसाध्यं मललक्षणम् ॥ १० ॥

<sup>३</sup> रुद्रतन्त्रात् अन्यस्मात् तन्नाच योगरत्नाकरेण दशमपृष्ठे उद्धृतम् ।

References showing difference between Agni and Pitta

पित्ताग्न्योः सम्बन्धः

ननु पित्तादन्योऽग्निराहोस्त्वरिपत्तमेवाग्निरिति सम्बद्धः ? उच्यते, पित्तस्योष्णा-  
दिगुणद्वारा आहारपाचनमन्तरं न दर्शनादिकर्मणश्च न खलु पित्तस्यतिरेकेणान्यो-  
ऽग्निः । तस्मादग्निरूपस्यैव पित्तस्य स्थानभेदात्पाचकरंजकसाधकालोचकाग्राज-  
कसंज्ञाः ।

तथा च वाग्मटः—

पाचकं तिलमानं स्यात् काठिन्याक्षास्य दोषता ।  
अनुगृह्णात्यविकृतं पित्तं पाकोष्मदर्शनैः ॥  
कुच्छुद्धूचिप्रभामेषाधीकौर्यतनुमार्दवैः ।  
पित्तं पंचात्मकं तच पक्वामाशयमध्यगम् ॥ १० ॥  
पंचभूतात्मकत्वेऽपि यत्तैजसगुणोदयम् ।  
स्यक्तद्रवत्वं पाकादिकर्मणाऽनलशिद्वितम् ॥ ११ ॥  
पचत्यज्ञं विभजते सारकिष्टैः पृथक् तथा ।  
तत्रस्थमेव पित्तानां शेषाणामप्यनुग्रहम् ।  
करोति वलदानेन पाचकं नाम तरस्मृतम् ॥ १२ ॥

ननु यदि पित्ताग्न्योरभेदस्तदा कथं शृतं पित्तस्य शमकमनेदीपकमिति । तथा  
मध्यस्याः पित्तं कुर्वन्ति न च तेऽग्निर्दीपिकरा इति । तथा पित्तादिवयात्तोषणोऽग्नि-  
रित्यपि कथं स्यात् । तथा “समदोषः समाग्निश्चेत्यपि” वक्तुं न युज्यते । तथा—  
“द्रवं ख्यात्यमधोगं च पित्तं वहिनस्तोऽन्यथेति ।”  
अन्नोच्यते पित्तमन्तः सन्तताधिष्ठानम् ।

तथा चोक्तं तन्नान्तरे

अग्निभिज्ञगुणैर्युक्तः पित्तं भिज्ञगुणैस्तथा ।  
द्रवं ख्यात्यमधोगं च पित्तं वहिनस्तोऽन्यथा ॥ १३ ॥  
तस्मात् तेजोमयं पित्तं पित्तोष्मा यः स शक्तिमान् ।  
स संचरति कुचिस्थः सर्वतो धमनीमुखैः ॥ १४ ॥  
स कायाग्निः स कायोष्मा स पक्ता स च जीवनम् ।  
अनन्यगतिरित्येव देहे कायाग्निरूच्यते ॥ १५ ॥  
तथा च मधुकोपे

“द्रवतेजः समुदायात्मकस्यापि पित्तस्य तेजो भागोऽग्निरिति । तेन पित्तम-  
ध्यग्निवन् मन्यते । अतितापितायोगोलकवत् । परमार्थं स्तु अग्निः पित्तादभिज्ञ-  
पूर्वेति सिद्धान्तः ।

## APPENDIX VII

A. Case of Agnibalaपारिक्षा

आयुर्वेदीयज्ञातकोन्तराशिळणकेन्द्रम्, ज्ञानगारम्

## अग्निचल-परीक्षा-पत्रकम्

नामः श्रीमान् महापूर अट्टी अड्डीभाई

वयः ३० वर्षणि

लिंगम् : पुरुषः

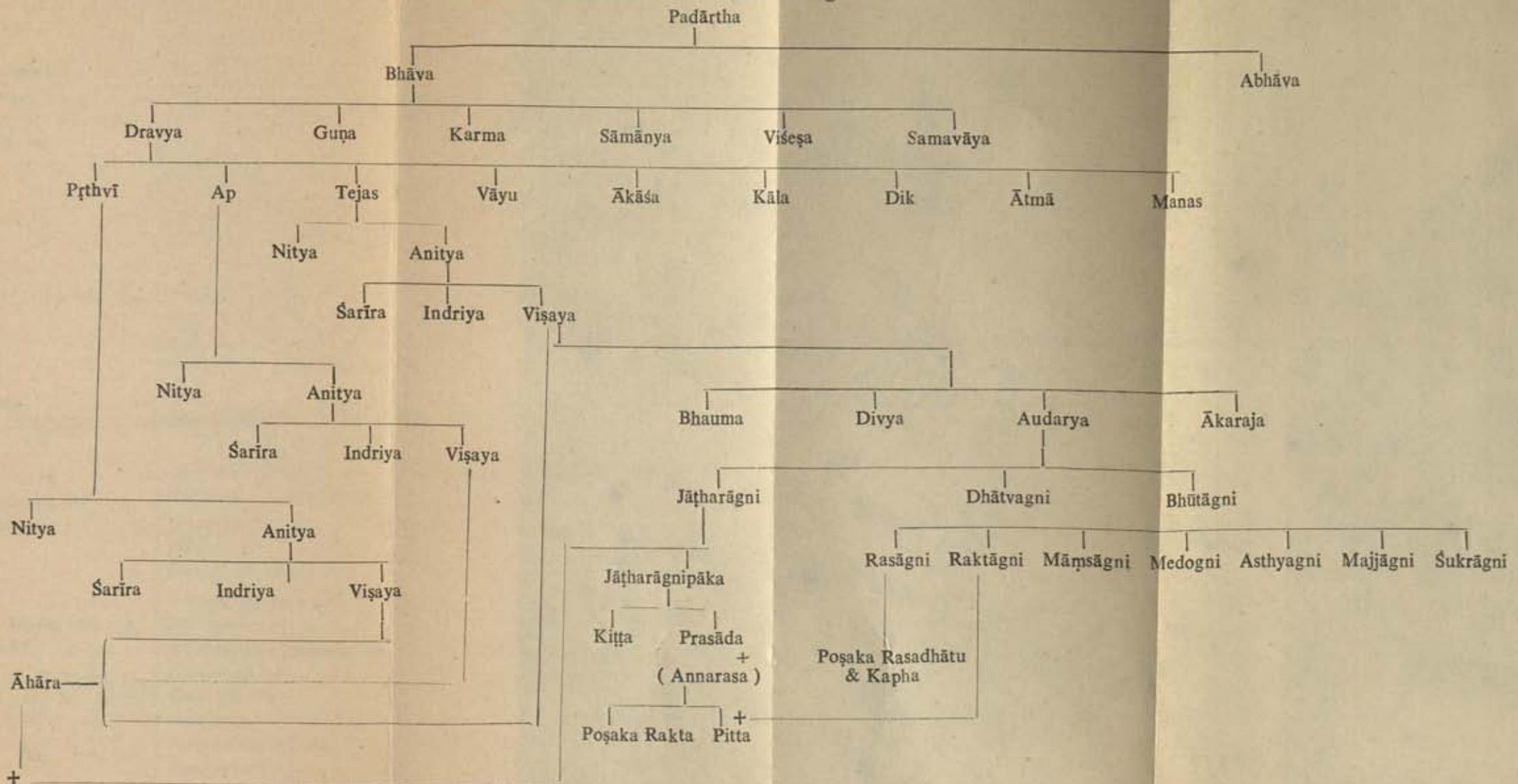
प्रधानावेदना : उच्चरः, यदा कदा विवेषः, कठिनमल्लयाः, वामचित्तदेवो रपशीसहस्रम्, यकृपदेवो शूलम्, रपशीसहस्रं च, तीव्रं कठीशूलम्  
 संक्षिप्तमित्युत्तम् : अष्टवृष्टः स्वप्ने बहुधा शुक्रमुतिः, मृश्यकृश्युतिः, सदाहमृश्यप्रवृत्तिः; तदनन्तरं षड्वृष्टः कल्यामासात्, संजातः, सप्तदिव-  
 साप्रमुति उच्चरः, शूलं, रपशीसहस्रं च ।

तिथिः	आहार वर्णनं परिमाणं च	आहारत्रुणः	मलपरिमाण	मलस्य वर्णनम्	पकापक्ष-परीक्षा	मलस्यम्
प्रथम दिवसः १९-८-५८ दि०	प्रातः: सायम्	कृष्णा लक्ष्मी, दोपन	२० तोङ्क,	सुपरिपि निहतः;	पकः	वामचित्त प्रदेशो यकृत् प्रदेशो शूलम्
स्थानाद नामापानः २०-८-५८	ओदनम् २० तो०	कृष्णा १० तो०	प्रातनन्तर-	कठिनः कृष्णः		
दिनांकस्य प्रातरष्टवानं याचत्	सुप्रम् ५ तो०	गोपूरमकप	वादनसमये	(पकारम्)		
	शाकम् ८ तो०	पौटिका ५ तो०				
	दुर्गम्	शाकम् ८ तो०				
	२० तो०					

तिथिः	आहारवर्णनं	परिमाणं च	आहारवर्णनः	मलपरिमाणं	मलस्य वर्णनम्	पक्वफृपरीक्षा	मलस्यम्
प्रातः	सायम्			समयम्	वर्णनम्	परीक्षा	
हृतीयदिवसः २०-८-५० ईव	—	—	—	३५ तो०	सपरिप्रिष्ठः, अर्ध- प्रातर्नेत्र	—	—
प्रातरस्त्रादादाद्याप्तय २१-८-५० ईव	—	—	—	—	आमः	—	—
प्रातरस्त्रादादनं यावत्	—	—	—	—	चनः, कुणाः	—	—
तृतीयदिवसः २१-८-५८ ईव	—	—	—	३५ तो० प्रातः	—	—	—
प्रातरस्त्रादादाद्याप्तय २२-८-५८ ईव	—	—	—	३५ तो० रात्र- रात्रवादनसमये	—	—	—
प्रातरस्त्रादादनं यावत्	—	—	—	—	(पक्ववारम्)	—	—
सामान्यविवेचनम्	—	—	—	—	—	—	—
प्रतिदिनं यावत् रोगी अस्त्रियः-परीक्षाय नियंजितः । प्रतिदिनं नातिशृष्टिवं यावत् अनुमानेन ५६ तोलक- मितमाहारं, २२ तोलकमितं दुष्यं न्यददत् । स अनुपातः: प्रतिदिनं ३० तोलकमितं मलस्यागमकरोत् । अविक्षिष्टस्याक्षयं स्वेदसूचादिमाणं निर्गमनं देहपोषणाय शारस्यादनार्थमूलोपदानाय च नियोजनमस्तूप् । उद्गरग्रेरवाप्ता गादिविक्षिष्टमलकृणमाचात् तत्य मलान्वरोध इति ज्ञायते ।							
अर्थात् माशायदयापापारः	—	—	—	—	—	—	—
अथ आमाशायदयापापारः	—	—	—	—	—	—	—
प्रथम दिवसे पक्वमलक्षणायोऽस्तु । तदनन्तरं दिवसहृष्टं यावत् आमाशलयाः । तस्मात् विषमेयमाहरपचन- व्यवस्था इति ज्ञायते । रसशोषण-व्यवस्थयां न हृष्टा काचिच्छिद्ग्रुहिः । सारकिटविभजनमपि न सम्यग्भवति इति विषमादतुमीयते ।							
पक्वाशयदयापापारः	—	—	—	—	—	—	—
सम्यग्भवति यावत् उपरिप्रिष्ठमलयापात्							
सम्यग्भवति नातिदिवः नातिव्याप्तिः इति ज्ञायते । दवशोषणं चापि							

## APPENDIX VI

### Scheme to Show the Relation Between Agni & Pitta.



NOTE:—Taken with certain alteration from Dinanātha's commentary on Mādhavanidāna 55: 22

**Indological Truths**

# *Indological Truths*

## INDEX

### A

*Abhikṣṇa mala pravṛtti*, 141  
*abhyantararoga mṛgā*, 50  
 Abraham White, 87, 106, 107  
 Abscess, *vidradhi*, 155  
*acehāpitta*, 35, 37, 39, 41, 42, 63, 66  
*acehāpitta*, complex, 30  
 acid, *kaṭu*, 66  
*āśintya śakti*, inconceivable power, 57  
*adha-ūmīśaya*, 41, 74, 84, 133, 154  
*adhibhautika*, 92  
*adhidaitika*, 92  
*Adhidanta*, 156  
*adhikaranya siddhānta*, 102  
*Adhimāṃsa*, Granuloma 155  
*adhipthāna*, 56  
*ādhnāna*, 94, 134, 160  
*Ādhmāna*, Tympanitis, 142  
*adhoguda*, 51, 52  
*Adhyasthi*, 156  
*ādhyātmika*, 92  
*aghāna*, 41  
*agneya*, 74, 75, 85, 90, 113, 115  
*agneya guna*, 26, 27  
*Agni*, 3, 8, 9, 16, 17, 22-26, 28, 29, 44, 49, 56, 73, 74, 83, *et passim.*  
*agnibala*, 116, 122, 129, 144, 174-75  
*Agnibala Parīkṣā*, 122, 124, 144, 150, 154  
*agnibhūta*, 26

*agnidhara kalasāra*, 47  
*agni duṭṭi*, 107, 109  
*agni, jaranyaśakti*, 128  
*agnimāndya*, Indigestion, 108-9, 140  
*Agnināśa*, 155  
 agni of the earth, 12  
*agni, pitta*, 66  
*agni ( pitta ) dharū kalā*, 46  
*agni, tejas*, 15, 20, 21  
*agni, vīma*, 109  
*agnyādhipthāna*, 151  
*agnyāśaya*, 51  
 aguesia, *arasajñatā*, 155  
*āhāra*, 26, 27, 38, 55, 66, 70, 75, 87  
*āhāra dravya*, 17, 24, 25, 37, 55, 60, 76, 81, 83, 85  
*āhārapūṣana*, 27, 39, 66  
*āhāra pācana*, digestion of food, 97  
*āhārapūṣanakriyā*, 50  
*āhārapūka*, 58  
*āhāraraśa*, 36, 67, 89, 112  
*Aharanya*, Impotency, 156  
*Āhata adhmāta*, 142  
*Ajūśakṣydeat mala pravartana*, 134  
*Ajīrṇa Saranya*, 140  
*ākaroja tejas*, 13  
*ākāśa*, 6, 56  
*Akṛṣṇayāpidaurbalya*, 143  
*Ākṛti*, 150-51  
*Ākṣepa*, 160  
*Akṣikūṭa Kṛṣṇalā*, 159  
*akṣimala*, mucoid excretions from the eye, 85

*Ālataya*, 143, 156, 159  
 alimentary canal, *kosṭha*, 114  
 alimentary canal, *mahāsrotas*, 114  
*Alji*, 155  
*Ālocaka*, 28  
*Āletakāgni*, 28  
*Alpa chardi*, 139  
*Alpamala*, 141  
*Alpāya prajanana*, 156  
*Āma*, 111-12, 117-18, 141, 151,  
 153-54  
*Āmadeṣa*, 109-11, 113-14, 117,  
 118, 154  
*Āmadeṣa*, *Āmaśaya*, 109  
*Āma* formation, 133  
*Āmagandhi*, 141  
*amalabhaṭṭa*, 60  
*Āma*, mucus, 154  
*Āmapakvāśaya*, 50  
*Amarakoṣa*, 24  
*Āma samśṛṣṭa mala*, 141  
*Āmāśaya*, 27, 35, 37, 41-44, 48,  
 51, 52, 61, 77, 79, 111, *et*  
*passim*,  
*ambukṣaya*, 115  
 aminio-acid-tyrosin, 152  
 aminopeptidase, 48  
*amla*, 30, 41, 61, 67, 71  
*Amla avasthā pūka*, 133  
*amlabhaṭṭa*, 35, 37, 38, 66, 75  
*amladravya*, 70  
*amlaḍpāka*, 112-13  
*amla rasa*, 71  
*amla*, sour, 56  
*amlatoṣa*, 38  
*Amla-udgāra*, 134  
*Amlodgāra*, 159  
 ammonia, 64, 85  
*Amrak*, 58

*Āmīṣa* *rk*, Pain in shoulder, 140  
*amśas* of *pūrakāgni*, 46  
*anadhika*, 30  
*Anāha* ( flatulence ), 142  
*analā*, 27  
*anala*, fire, 43  
*Anannābhilāṣa*, 159, 170  
*Andhra*, 72  
*Āṅgadāha*, 156  
*Āṅgamarda*, 159  
*Āṅgamarda*, body-ache, 155  
*Āṅgapīḍana*, 134  
*Āṅgasuptatā*, 156  
 Anger, 111  
*āniṭya*, non-eternal, 11  
*āniṭya*, transient, 12, 57  
*anna*, 22, 122  
*Annadveṣa*, 143  
*annakīṭa*, 87  
*Anna mārdava karana*, 133  
*Annamībhāṭṭa*, 11  
 Annambhaṭṭa's *Tarkasamgraha*, 171  
*annapacana*, 62  
*annapravreṣa*, deglutition, 60  
*annarasa*, 85, 88, 111, 122  
*anna*, *sema*, 22  
*annavahasroṭa*, 77, 79, 99  
*annavaha srotāṁsi*, 81, 97  
*annavidecana*, 62  
*Anoroxia*, *asraddha*, 155  
*antarāgni*, 25, 27, 28, 42, 82, 109,  
 120, 126  
*antrakāṭjana*, 94  
*Āntra vikujana*, 140  
*Āntrika sannipāta jvara*, 153  
*ānu*, 9, 14, 17, 18, 20, 56, 57  
*Anubandha ūṭīla*, 142  
*ānutea*, 56  
*āorta*, 104

ap, 9, 56  
*Apakeśāna*, non-digestion of food, 133  
 apāna, 65, 66  
 ap-bhūta, 26  
*Apīdravāśoṣaṇa*, 134  
*Apraśāamaruk*, 158  
 apratighīta śakti, 147  
 apya, 72, 74, 75, 88  
 apyabhūta, 85  
 apyaguna, 59  
 krambhavāda, 9  
*Arasajñatā*, aguesia, 155  
*Arbuda*, Tumour, 155  
 ardhaśakti, 144-46, 149, 172-75  
*Ārdraearamāvanaddhā bhagātratā*, 158  
 arrogya, positive health, 122  
 artava, 92  
 arterioles, 104  
 Aruci, 157  
*Aruci*, Distaste, 143, 155  
*Aruṇa*, Redish, 141, 153  
*Aravda*, 157  
 āśaya, 36  
 āśava, Organ, 77  
 ascitis, *jathara*, 94  
 aśita, 37  
*Āśraddhā*, anoroxia, 155  
*Āśramandala*, 155  
*Āśrghara*, menorrhagia, 155  
 aśṭāṅgahṛdaya, 43, 44, 99  
*Āśṭāṅga Saṃgraha*, 49, 83, 91  
 aśṭasthāna parīkṣā, 129  
 asthāyi dhūtu, 83, 84, 97  
 asthāyi, poṣaka, 85  
 asthāyi, poṣaka dhūtu, 117  
 asthāyi rasadhūtu, 85  
 Asthenia, sāba, 155  
 Asthi, 156, 158  
 Asthibheda, 156, 158  
 asthidhūtu, 85  
 Asthiśeṣa, 158  
 Asthiśula, 156  
 asthyagni, 82, 85  
 Aśvapna, 158  
 Aśvāsthya, 159  
 aṣṭya, 146  
 Āśya mādhurya, 143, 156  
 aṣyamala, 85  
 Aṣyapaka, Stomatitis, 155  
 Āśya ūṣa, 143  
 Āśyavairasya, 155, 159  
 Āśyopdeha, 143  
 Āśyo vairasya, 170  
 Ātānana, 157  
 Ātākadarpaṇa, 117  
 Atidravaśoṣaṇa, 134  
 Atidurgandhi, 141  
 atipravṛtti, 108  
 Atiraktasrāva, 160  
 atisāra, 115, 150-51, 160  
 atisāra, diarrhoea, 94, 108  
 ativayyama, 146  
 Āṭopā, 142  
 atyagni, 45, 48  
 Atyartha Śramita, 158  
 Atyartha tudana, 157  
 atyugni, 95  
 audaryatejas, 11, 12  
 aśaikārikas, 114  
 aśava, 121, 173  
 Aśvabala, 174  
 Aśvāśi, 141, 153  
 Aśvāśitva, 154  
 aśvasthāpaka, 38, 55, 60, 61, 66, 76, 112-13  
 Aśvadagha-pravartana, Urdoamārga,

*Avipaka*, 140  
*Avranagranthi*, 158  
*ayana*, 100, 104-5  
*ayanamukha*, 98, 101, 105  
*ayanamukhas of srotāmī*, 18, 100  
*Ayathākāla palita*, 155  
*Ayathākālavatī*, 155  
*Āyurveda*, 23, 26, 27, 32, 33, 50, 59, 62, 67, 82, 92, 104, 109, 114, 150, 170, 174-75  
*Āyurveda Śūtra*, 68, 69, 71, 101  
*Āyurveda Vṛddhahṛayī*, 42  
*Āyurvedic*, 50  
*Āyurvedic classics*, 31, 70, 97, 98, 172, 174  
*Āyurvedic collection*, 124  
*Āyurvedic concept*, 28  
*Āyurvedic description*, 60, 151  
*Āyurvedic doctrine*, 107  
*Āyurvedic literature*, 130  
*Āyurvedic texts*, 28  
*Āyurvedic version*, 64  
*Āyurvedic view*, 64, 87, 88, 107, 129, 150, 170  
*Āyurvedic works*, 144  
*Āyus*, longevity, 122

## B

*baellus bifidus*, 115  
*baellus bulgaricus*, 116  
*bahumūtra*, polyuria, 108  
*Bahupicehila*, Extreme sliminess, 133  
*bahu picchilata*, 112-13  
*bala*, strength, 121-22, 149  
*Balakṣaya*, 143, 158  
*bala nīrṇaya*, 172  
*balaparikṣa*, 144  
*balas*, 174  
*Bala-vyāyāmaśakti*, 172

*balin*, strong, 145  
*Baylias*, 62, 66  
*beard*, *smaśru*, 86, 88  
*Beaumont*, 90  
*bhrāharana* 147  
*bhasmaka*, 45, 48, 95  
*bhīṣvara*, 10  
*Bhāṭṭoji's Siddhāntakaumudī*, 23  
*bhauma tejas*, 12  
*bhautie composition*, 70  
*bhautie groups*, 74  
*Bhāva Miśra*, 25, 29  
*Bheda*, 134  
*bhinnamala* 141  
*bhinnasamghāta*, 37, 61, 81, 133  
*bhinnasamghāta*, splitting, 23  
*Bhoja*, 25  
*bhrājaka*, 28  
*bhrājakāgni*, 28  
*Bhrāma*, 133, 143, 156, 159  
*Bhrāsatīt*, 158  
*Bhrāśa vāmana*, 158  
*Bhukta stambha*, 157  
*Bhukte svāsthya*, 139  
*bhūta*, 56  
*bhūta class*, 73  
*bhūtādi*, 5, 6  
*bhūtagni (s)*, 28, 38, 67, 73, 97, 117, 147, 171  
*bhūtagnipāka (s)*, 72, 74, 75, 76, 83, 85  
*bhūtagni vyāpāra (s)*, 49, 77, 119  
*bhūta group*, 72  
*bhūta paramāṇus*, 56  
*bhūta pentad*, 43  
*bila*, 40  
*bile pigment*, *pitta*, 85  
*bilirubin*, 31, 32  
*bilirubinemea*, 32

black, *kṛīma*, 153  
 Black mole, *tilakālaka*, 155  
 bladder, 40  
 bladder, *vasti*, 51, 52  
 Blue mole, *nālikā*, 155  
 blue, *nīla*, 153  
*bodhaka kapha*, 58, 59  
 Body-ache, *āṅgamarda*, 155  
*bṛhadantra*, 66, 77, 115  
 burning, *dahana*, 23, 24  
*buddhi*, 34

**C**

*Cakrapāṇi* Datta, 24, 25, 28, 32, 38, 41, 52, 63, 84, 100, 102, 114, 117, 119, 131  
*Cakrapāṇi's commentary*, 83, 91  
 Calcium, 87  
*Canakayuṣṭhā*, 153  
*Capillary*, *rasavāhini*, 77  
*Capillary system*, 104  
*Caraka*, 9, 21, 24, 26, 28, 29, 32, 33, 37, 38, 42, 49, 52, 60, *et passim*.  
*Caraka Samhita*, 28, 44, 76, 83  
 Carboxyptopeptidase, 48  
*Carmadala*, A type of skin disease, 155  
 Cathepsins, 48  
 Cervical adenitis, *gandamāla*, 155  
*Chardi*, emesis, 94, 159  
 Chemical action(s) *pāka(s)* 15, 21  
*Cholecystokinin*, 39, 40  
*Chyme*, 41  
*Cirrīt*, 141  
 Colouration, *rañjana*, & *varṇakara*, 23  
 Colour, *rasa*, 10  
 Combustion, *dahana*, 24  
 Complex, *asēhapitta*, 30

Complexion, *varṇa*, 122  
 Conjunction, *samiyoga*, 10  
 Consistency, *Samhatattva*, 151  
 Continuum, *vibhū*, 6, 56  
 Conversion, *parinamana*, 23  
 Copper, 90  
*Coṣa*, 133  
 Cough, *kasa*, 94

**D**

*Dadru*, Ring worm, 155  
*dāha*, 94, 133, 143, 157  
*dahana*, 46, 148, 175  
*dahana*, burning, 23, 24  
*dahana*, combustion, 24  
*dahana*, oxidation, 24  
*dahanakarmas*, 25  
*Dainya*, 159-60  
*Dalhaṇa*, 25, 101-2, 117, 119-20  
*Dandāhatasat vedanī*, 157  
*Dantabheda*, 156  
*Dantaśīla*, 156  
*dūrśanika*, 170  
*daśamadhāmūlahamani*, 102  
*Daurbalya*, 159-60  
*daurgandhya*, 112-13  
*Daurgandhya*, four smell, 134  
 deglutition, *annapravesa*, 60  
*dehagni*, 27, 122  
 dehydration, 49  
*de nove*, 80  
*dhamani(s)*, 51, 79, 102-3, 105, 147  
*dhātu*, 36, 43-49, 74, 85, 96, 98-107, 117, 119, 121, 147-48, 175  
*Dhatugrahanānihṛtam*, 102  
*dhātu kitta*, 87  
*Dhātukṣaya*, 159  
*dhātumalas*, 105

dhātuparamparā, 43  
 dhātuśmā, dhātuagni, 82  
 dhātuwaha srota, 102  
 dhātuwaha srotāṁsi, 82, 97, 104, 106, 116  
 dhātuverddhi, 45, 96  
 dhātuagni, 28, 73, 82, 84, 117, 119, 147, 152-53, 171  
 dhātuagni, dhātuśmā, 82  
*Dhātuagni Māndya*, 117, 153  
 dhātagnipaka, 38, 67, 81-83, 85, 88, 91, 117-18, 122, 172  
*Dhātuagni prasūda*, 87  
 dhātagni vyāpāra, 80, 85, 87, 88, 97, 106, 117, 154, 171-72  
 dhātuharas, 82, 91  
 dhātūśayantara maryāda, 102  
 dhmāna, pulse vibration, 103  
 diarrhoea, atisūra, 94, 108  
 digestion of food, bhūrapūvana, 97  
 digestion, pāvana, 23, 24  
 dik, 3, 15  
 dilation, granthi, 108  
 dimension, parimīṭa, 10  
 dinatva, 115  
 disjunction, vibhāga, 10  
 distaste, aruei, 155  
 divya tejas, 12  
 Dog, 58  
 dorsalis, 104  
 doṣa, 59, 94, 95, 117, 119, 150  
 doṣācaya, 117  
*Doṣādiviññāṇya*, 43  
 doṣa duṣṭi, 112  
 doṣa-doṣya-sammudrehāṇi, 107  
 doṣagnis, 28  
 duodenal glands, 39  
 drava, 27, 30, 43, 26, 115, 141

Drava, Liquid, 141  
*Drava mala pravartana*, 134  
*Drava-śeṣaṇa*, 134, 152, 154  
 dravatva, fluidity, 10  
 dravya, 21, 43, 56, 58, 67, 70, 72, 113, 129  
 drīḍhatā, hardness, 120  
 Drowsiness, *tandri*, 155  
*Dṛṣṭvat̄ sabda*, 142  
*Duhkha*, 141  
 duodenal mucosa, 40  
 duodenum, 39, 40, 46, 47  
 duffa, 110  
 dupti, 108  
*deyaṇukas*, 10, 18, 19  
 Dwarakanath, C., Prof., 57  
 dysentary, *prāvihāna*, 94  
 dyspnea, *īsāsa*, 94, 146  
 effect, kārya, 12  
 elan-vital, *prāṇa*, 122  
 emesis, *ehardi*, 94  
 endocardium, 104  
 Enemity, 111  
 energy, *rajas*, 4, 5, 8  
 enlargement of spleen, *pliha*, 155  
 entero-gastrone, 39, 40  
 Envy, 111  
 enzymes, 40  
 eructation, *udgāra*, 60  
 erythrocytes, 30, 90  
*Escherichia coli*, 64  
 eternal, nitya, 11, 12  
 Extreme sliminess, *Bahupiechila*, 133

**F**

faeces, *pūrpa*, 85  
 faeces, *śakti*, 65  
 faintness, *tamas*, 155  
 Fantum tumorous, *gulma*, 155  
 Fear complex, 111

femoral, 104  
 Fermentation, *Suktapāka*, 133  
 Fever, *jaara*, 155  
 fire, *anala*, 43  
 fluidity, *dravatva*, 10  
 Freckless, *Vyaṅga*, 155

**G**

*Galaīluka*, 155  
*galaśoja*, 94  
*Galaśunḍika*, Tonsilitis, 155  
*gamanāgamana*, 147  
*Ganda*, 155  
*Ganda* & *akṣikuta* *śetha*, 133  
*Ganda māla*, Cervical adenitis, 155  
*Ganda rūgatva*, 160  
*gandha*, 144, 150  
*gandha*, smell, 153  
*gandha tanmātrā*, 6, 8  
*Gaṅgādhara* Sena 41, 68  
*Gangrene*, *Pūtimānasa*, 155  
*Garbha Kṣipra Muñecana* & *Bandhana*, 158  
 gases, *vāta*, 85  
*Gastrin*, 39  
*Gūtra* *Arūḍi*, 157  
*Gūtrasadana*, weakness of the body, 94  
*Gūtrastambha*, 143  
*Gaurava*, 143  
*gaurava*, heaviness, 94, 155  
*gingili* cake, *tilapīṭa*, 131  
*Glomerular capillaries*, 106  
 God, 58  
 Goitre, 155  
*grahaṇī*, 35, 36, 41, 42, 52, 79, 81  
*grahaṇītrogyn*, patient suffering from sprue, 150  
*grahaṇī*, small intestine, 151  
*Granthi*, 156, 185  
*granthi*, dilatation, 108  
*Granuloma*, *adhimānisa*, 155  
*Grathita* ( *Scybolous* ) 141  
 greed, 111  
*Gṛīma*-June and July, 145  
*Grassman*, 41  
*Gulma*, Fantum tumorous, 155  
*guna*, 3, 4, 16, 56, 57  
*Gurbaṅga*, 157  
*Guru*, heavy, 141  
*Guruṭa*, Heaviness, 133  
*Gurutva*, heaviness, 140

**H**

haemoglobin, 31  
 haemolobin, complex, 30  
*Haemorrhage*, *rakta-pitta*, 155  
 hairs all over the body, *lema*, 86  
 hairs, *keśa*, 86, 88  
 hardness, *dṛḍhatvā*, 120  
*Hāridranakha*, 158  
*Hāridranetra*, 158  
*Harita*, 141  
*Harṣa*, 143  
 heart, *hrdaya*, 51, 101  
 heat production, *tāpasa*, 23  
 heaviness, *gaurava*, 94, 133, 155  
 heaviness of abdomen, *udaragaurava*, 94  
 heaviness of the head, *siregaurava*, 94  
*Hemanta*, December and January, 145  
*Hikka*, 159  
 hormone, 40, 41, 46, 47  
 hot, *uṣma*, 10  
*Hṛdaya*, Pre-cardinal pain, 140  
*hrdaya*, 68, 76, 102, 121, 145, 147, 174-75  
*hrdaya*, heart, 51, 101

*Hṛdayadrava*, Palpitation, 140

*Hṛdaya syāthā*, 159

*hṛdistha*, 146

*hṛdisthita vāyu*, 145-46

*Hṛilāsa*, nausea, 155

*Hṛt dāha*, 159

*Hṛt dravata*, 159

hydrogen, 64, 116

hydrogen sulphide, 85

hydrolysis, 49

## I

ilea cecum, *uṇḍuka* region, 115

illumination, *prakāśana*, 23

Impaired vibhajana, 134

impatience, 111

impotency, *Klaibya*, 155

Improper pīḍī karana, 134

inconceivable power, *aeintya* *śakti*, 57

increase of cheerfulness, *utsāhepataya*, 122

*īndhana*, 26, 43, 45, 49, 121-22, 147-48, 172

*Indhātagni pūka*, 75

indol, 64, 85, 116

indol-acetic-acid, 87, 88

*indriya-tejas*, 12

infinite, *vibhu*, 56

Iron, 90

insipidus, 108

Ivy, 66

## J

*Jalaparīkṣā*, 150

*jale dara*, 46, 47

Jamnagar, 46, 172, 174

*jarāṇasakti*, 50, 122, 144, 174

*jarāṇasakti*, *agni*, 128

*jāthara*, ascitis 94

*jātharāgni*, 27, 38, 42, 49, 55, 61,

63, 67, 70-73, 75-77, 83, 87,

88, 91, 93, *et passim*

*jātharāgni māndya*, 117, 153

*jātharāgnipaka*, 58, 66-68, 72, 73, 117, 171

*jātharāgni syūpāra*, 63

*jātharānala*, 11

Jaundice, *Kāmalā*, 155

*jihvā*, 146

*jihvā upadeha*, 159-60

*jīrjati sūla*, 140

*jīrye prakopa*, 142

*Jvara*, 143, 160

*Jvara*, fever, 155

## K

Kahlenberg, 70

*Kakṣa*, 149

*Kalā*, 36, 102, 108

*Kalā*, 3, 15

*kālaja*, 120

*kāmalā*, jaundice, 155

*Kanḍa*, 9

*Kanḍa rahasya*, 10

*Kaṇḍara*, 147

*Kaṇḍara Khalli*, 156

*Kaṇṭha*, 146

*Kaṇṭha dāha*, 143

*Kenṭha* *śoṣa*, 143, 156

*kapha*, 52, 58, 59, 94, 95, 120, 139, 150, 153

*Kapha duṣṭi*, 152

*Kāraṇa*, 3

*kārana* and *kārya*, 20

*kārana dravya*, 56, 57

*Kāraṇākāśa*, 5, 6

*Karapūḍadāha*, 156

*Karma*, 20, 21, 46, 58

karma, motion, 21  
 karmaśakti, energy, 120, 175  
*Karṇamala*, waxy excretions from the ear, 85  
*Kūrṣya*, 143  
*kūrya*, 3  
*kūrya*, effect, 12  
*kūryukūṣa*, 6  
*kūrya*, products, 11  
*Kūśa*, cough, 94  
*Kaṣṭya*, 67  
*Kaṣṭya chardi*, 139  
*Kaṣṭya rasa*, 72  
*Kāśyapa*, 29  
*kaṭu*, 30, 67  
*kaṭu*, acid, 56  
*Keṭu*, pungent, 56  
*Kaṭu vakraṭa*, 143  
*Kaṭu vīpūka*, 70  
*Kūyachidra-śpadeha*, 156  
*Kāya eikitsa*, 46, 109, 150  
*kāyagni*, 44, 109–11  
*kāyamala*, 156  
*Kēśa*, hairs, 86, 88  
*Kēśa jaṭilibhāṣa*, 156  
*Kēśaloma*, 156  
*Khaḍita*, 37  
*Khara*, 16  
*kha-raigunya*, 108, 117  
*Kha-vaigunya*, *srota-vaigunya*, 107  
 Kidneys, *ṛekka*, 51, 52  
*Kila*, waris, 155  
*kiñcīspakva-Kiñcidopakva* 38  
*kiṭṭa*, 27, 35, 43, 50, 75, 76, 84, 87, 91, 105, 172, 175  
*Kiṭṭa bhāga*, 27  
*Kiṭṭamīla*, 175  
*Kiṭṭapaka*, 84–88  
*Klaibya*, impotency, 155  
*Klaibya*, Sterility, 156  
*Kledaka kapha*, mucin, 59  
*Kliba prajanana*, 156  
*Klinna*, 60  
*Kodrava*, 110  
*Koṣṭha*, 27, 35, 37, 50, 55, 58, 61, 65, 74, 77, 144, 149, 151, 172  
*Koṣṭha*, alimentary canal, 114  
*Koṣṭhāgnī*, 27, 42  
*Koṣṭhāṅgas*, 51  
*Koṣṭha*, Rashes, 155  
*Koṣṭhāśrita Kūmala*, 131  
*Kṛchrena chardi*, 139  
*Kriyūkālas*, 107  
*kṛmis*, 114–15  
*kṛmis*, worms, 154  
*Kṛṣṇa*, 157  
*Kṛṣṇagatā*, wasting, 155  
*Kṛṣṇatā*, 157  
*Kṛṣṇa*, 141, 157  
*kṛṣṇa*, black, 153  
*Kṛṣṇa shardi*, 139  
*Kṛṣṇa*, Tarry, 141  
*Kṛṣṇa*, 19  
*Kṛṣṇavathu*, 143  
*Kṛṣṇa*, 45, 160  
*Kṛṣṇa śukra muñeana*, 158  
*Kṛṣṇa śukra sandhana*, 158  
*Kṣudrānta*, 82, 66  
*kṣudrāntra*, 51, 76, 77, 115–16  
*Kṣudraroga*, 25  
*Kṛut*, 35, 159  
*Kṛut*, Appetite, 140  
*Kṛut vāiparitya*, 159  
*Kukṣi ruk*, 142  
*Kuṣṭha*, skin diseases, 155

## L

*lakṣaṇa*, 126, 145  
*Lakṣaṇīvalī*, 10  
*Lāta praseka*, 159  
*talūṭa*, 145  
 large intestine, *pakṣīsaya*, 52  
 laryngotracheal ridge, 55  
*lavaṇa*, 67, 70, 71  
*Lavaṇa praseka*, 140  
 Leucoderma, *śvītrā*, 155  
*līḍha*, 37  
 location, *sthāna*, 77  
*loma*, 88  
*loma*, hairs all over the body, 86  
*lomakūpamala*, 85  
 longevity, *ayus*, 122  
 Levatt Evans, 66  
 lung, *phupphusa*, 52  
 lusture, *prabhā*, 122

## M

*Madhava Niśāsa*, 25, 111, 117  
*Madhukoṣa* commentary, 111  
*Madhukoṣayūkhya*, 25  
*madhura*, 38, 59, 67, 71  
*Madhura avasthā pūka*, 133  
*madhurabhāṣa*, 37, 58, 60, 66, 75  
*madhura pūka*, 113  
*madhura rasa*, 70, 72, 129  
*madhura*, sweet, 56  
*madhura vīpūka*, 70, 71  
*madhya*, 16, 121, 173  
*Madhyabala*, 173  
 magnesium, 87  
*mahābhūta*, 6, 73  
*mahānimna*, 50  
*mahāirota*, 39, 50-52, 65, 66, 77,  
 79, 97, 115, 174  
*mahīsrota*, alimentary canal, 114  
*majū*, 82, 156, 158

*majādhūtu*, 85  
*majāgni*, 82, 85  
*mala*, 89, 99, 100, 108, 112, 144,  
 117, 129, 150  
*mala(s), doṣas*, 107  
*mala parīkṣā*, 144  
*Ma/a apravṛtti*, 134  
*malāgnis*, 28  
*mala-mūtra vibhūjana*, 134  
*mala of rakta*, 30  
*mala parīkṣā*, 129, 150  
*malarañjaka*, 33  
*malarañjaka-pitīta*, 87, 131-32  
*malarañjaka pitta*, stercobilinogen, 152  
*malarepa vāyu*, 105  
*Malarepa vāyu pravartana*, 134  
*malasañcaya*, 117  
*malas*, waste products, 98  
*māṁsa*, 82, 120-21, 155, 157, 174  
*māṁsabala*, 144  
*māṁsabala*, 172, 174-75  
*māṁsabala parīkṣā*, 124, 144  
*māṁsadhūtu*, 36, 85, 106, 120, 122,  
 147, 148, 174  
*māṁsagni*, 82, 85  
*Māṁsakṣaya*, 158  
*māṁsapeśī*, 121, 147  
*māṁsīsa rasa*, 38  
*māṁsavaha sretas*, 106  
*Māṁsavakothana*, 157  
*mana*, 9  
*manda*, 93, 174  
*mandāgni*, 45, 46, 94-96  
*Maṇḍaruk granthi*, 158  
*mārdava*, 34  
*mārga*, pathway, 77  
*Marīci*, 24, 33  
*māruta*, 82  
*Masurikā*, 157

mātrū, 122  
 mātrū of īma, 148-49  
 medas, 120, 156, 158  
 medhā, 34  
 medhārkt, 34  
*Medhrapaka*, pudentitis, 155  
*Medinī*, 24  
 medodhātu, 85  
 medogni, 82, 85  
*Meha*, 158  
 Melanin, 152  
 Menorrhagia, *asrgdara*, 155  
 mersalyl, 47  
*mithuna*, 22  
 mucus, 40  
*Moha*, 134, 143, 160  
*Moha sannyāsa*, 160  
 Moieties, 44  
 motion, *karma*, 21  
 mouth, *vaktra*, 145  
 mydu, 16  
 mucin, *Kledaka kapha*, 60  
 mucoid excretions from the eye,  
     *akṣimala*, 85  
 mucoid excretions, *ślesman*, 85  
 mucus, īma, 154  
 mukha, 100, 101, 104-5  
 mukhāni of *srotāṁsi*, 104  
*Mukhaśuṅkata* 159  
*Mukta Oṣha* *śoṣa*, 170  
*mula* *dhamanīs*, *srotas*, 174  
*mula* of *rasavaha*, 174  
*mulaprakṛti*, 3, 4, 8  
*mula*, root, 124  
*Murehā*, 133, 156  
*Murehā*, *sannyāsa*, 159  
*murdhā*, 60  
*Muṣṭhitavat*, 158  
*mūra*, 86-88, 129  
*Mutra parivartana*, 160  
*Mutrāśaya*, 51  
 mūtra, urine, 85  
 myxedema, 46  
 Mysore, 46

**N**

nabbasa, 56, 72, 74, 75, 85  
 nābhi, 50  
*Nabhidesa dāha*, 140  
 nābhi, pancreas, 52  
*Nābhi vikṛiṭi*, 141  
 nāḍi, tubes, 77  
 nādīvega, 149  
*Nāgārjuna*, Bhadanta, 68  
 nail, *nakha*, 88  
*Naiyāyikas*, 20  
*nakha*, 86  
*nakha*, nail, 88  
*Nūlikā*, blue mole, 155  
 nasal discharge, *nāṣikāmala*, 85  
 nāṣīḍā, 146  
*Nāṣikāmala*, nasal discharge, 85  
 Nausea, *hṛilāsa*, 155  
*Nāpadravya*, 9  
*neplus-altra*, 56  
*nidāna*, 114  
*Nidrā*, 143  
*Nidrā ghīṭa*, 159  
*Nidrānāśa*, 160  
*nīṣṭarāṇa*, 101  
 niketa, repertory, 77  
 nīla, 30, 130  
*Nītabha*, 141  
 nīla, blue, 153  
*nīmittakārana*, 26  
 nīrukti, 100  
*Niṣṭhivana* ( Spitting ), 140  
 nītya, eternal, 11, 12  
 nodana, 15

non digestion of food, *Apakēśīna*, 133  
 non eternal, *aniśīya*, 11  
 number, *sāmkhya*, 10  
**Nyāya**, 15  
*Nyāyabodhīnī*, 11  
*Nyāya-bodhīnī* commentary, 171  
*Nyāya-vaiśeṣīka*, 9, 18, 20, 21, 56, 171  
**O**  
 oedema, 46  
 oesophagus, 61  
*oja*, 102  
*ojahkṣaya*, 102  
*oja*, resistance to disease and decay, 122  
*ojakṛt*, 34  
*ojecūhīnīs*, 102  
*ojecīramīsa*, 102  
*ojeyūpat*, 102  
 omentum, *apīrahana*, 51  
 Orissa, 72  
*Oja*, 133  
*oṣṭha* *śesa*, 94  
 oxidation, *dahana*, 24  
 oxygen, *vijātīyatejas*, 147  
**P**  
*pāneṣīa*, 149  
*pāneakagnī*, 27, 28, 42-44, 47-49, 75, 81, 108, 122, 147-48  
*pāneavāñjas*, 45, 48, 49, 85, 89, 90, 96, 108, 117, 119, 122, 147, 172, 174  
*pācana*, 25, 46, 154  
*pācana*, digestion, 23, 24  
*pānīkapitta*, 27, 28, 30, 35, 36, 42, 44, 49, 122, 171  
*pāyamūñīṣaya*, 51, 52, 63  
*Padadeśīha*, 160  
*pāka*, 11, 16-18, 20, 55, 56, 67, 74, 79, 81, 82, 84, 117, 175  
*pākabhedas*, 16  
*pāka*, chemical-action, 15, 21  
*pākādi karma*, 17, 27, 43  
*pakaja*, 16  
*pāka karma*, 24  
*Pākakṛtī*, 15  
*Pāka*, Proctitis, 141  
*pakti*, 35  
*pakvūpākṣa*, 38  
*pakvūṣaya*, 27, 35, 42-44, 48, 51, 52, 63-65, 77, 86, 87, 115, 134, 151, 153-54, 172  
*pakvūṣaya*, large intestine, 52  
 pallor, *pāṇḍutva*, 155  
*Pāmī*, Scabies, 155  
*pāna*, 122  
*pāne bhautī*, 26, 43  
*pāneabhetas*, 26  
*pāneakarma*, 109  
*pāneamahābhutas*, 68  
 pancreas, 39, 40, 52  
 pancreas, *nābhi*, 52  
 pancreozymin 39  
*Pāṇḍu*, 160  
*Pāṇḍutū*, 159  
*Pāṇḍutva*, pallor, 155  
*Pāṇḍutivarjita*, 30  
*Pāṇḍavamaya*, 157  
*pānīha*, passage, 77  
*paramānu*, 10, 11, 14, 16, 17, 19, 20, 56  
*paratīvaparata*, priority, and posterity, 10  
*paravṛitti*, transformation, 23  
*Parkartika*, sawing pain, 140  
*parikṣa*, 154  
*parimanī*, dimension, 10

*parināma*, 3, 18, 24  
*parinamana*, 63  
*parinamana*, conversion, 23  
*parispanda*, 13  
*parispandana*, 7  
*paripassu*, 45, 48, 70  
*paripindita pakṣaśaya*, 63  
*parīkṣārak*, ( pain in flanks ), 140  
*parthica*, 72, 75, 88  
*parthiva Bhāva*, 85  
*parthivāmīa*, 85  
*Paruṣa*, Rough, 141  
*Parvabhedā*, 158  
*Parvaruk*, 156-57  
*paryāya*, 101  
*passage*, *pantha*, 77  
*pathway*, *mīrga*, 77  
*passana*, 56  
*Pāṇu vikṛīti*, 141  
*pedis*, 104  
*pelvic colon*, *purīyādhara*, 52  
*pepsin*, 48, 49  
*Pessimistic outlook*, 111  
*pharmacology*, 70  
*pharyngeal arches*, 53  
*pharyngeal pouches*, 55  
*pharynx region*, 53  
*Phenavat* ( Forthy ), 141  
*phenol*, 64, 88, 116  
*phenyl sulphate*, 88  
*phosphates*, 87  
*phuphusa*, 52, 147, 174  
*phuphusa*, lung, 52  
*Picchānugata* ( Slimy ), 141  
*Picchila puriṣa*, 141  
*Pīdaka*, pimples, 155  
*pīlu*, 16, 17  
*Pīlupāka*, 16, 19  
*pimples*, *pīdaka*, 155  
*Pīṇḍikarana*, 134, 151  
*Pipāsa*, 156, 160

*Piplu*, Port wine marks, 155  
*pīta*, 37  
*Pītābha*, 141  
*Pītāvabhāsa*, 158  
*pīta*, yellow, 153  
*pīthara*, 17  
*pīthara pāka*, 16, 20  
*pitta*, 23-35, 43, 44, 52, 82, 93, 122, 139, 153, 170  
*pitta*, *agni*, 66  
*pitta* ( *agni-* ) *dharū kalū*, 42, 47  
*pitta* and *agni*, 24  
*pitta*, bile pigment, 85  
*pittadharū*, 48  
*pittadharū kalū*, 35, 36  
*pittāntargata*, 24  
*pitta sthānas*, 132  
*pittāvṛddhi*, 32  
*pitta vyāpara*, 24  
*pīlhā*, 132  
*pīlhā*, Enlargement of spleen, 155  
*pīlhā*, spleen, 30, 51  
*polyuria*, *bahumatra*, 108  
*Port wine marks*, *piplu*, 155  
*poṣaka*, 83, 84, 97  
*poṣaka*, *asthāyi* 85  
*poṣaka*, *asthāyi dhūtus*, 101  
*poṣaka dhūtu*, 90, 106-8  
*poṣaka dhūtus*, *asthāyi*, 117  
*poṣaka dhūtus*, *prasūda*, 172  
*poṣakadravyas*, 45, 89, 105, 174  
*positive health*, *ṛogyā*, 122  
*Post Graduate Training Centre*, 46  
*Post Graduate Training Centre in*  
*Āyurveda*, 144  
*Post-mortem*, 49  
*poṣya*, 81, 83, 84  
*poṣya dhūtus*, 97  
*poṣya dhūtu*, *asthāyi*, 117  
*poṣya*, *sthāyi*, 85  
*Pot*, 58

Povolv, 66  
*prabha*, 34  
*prabhikara*, to cause lustre, 23  
*prabha*, lusture, 122  
*prabhava*, 57  
*Pracura*, 141  
*prajanana mala*, smegma and vaginal discharges, 86  
*prakāśana*, illumination, 23  
*prakṛti*, 92  
*prākṛta*, 175  
*prākṛta kapha*, 120  
*prakṛti* रूपम्, 149  
*prakṛti*, 7, 151  
*prakupita doṣas*, 98, 99  
*prāna*, 22  
*prāna*, elan vital, 122  
*prānavaḥa srotas*, 174-75  
*prāṇavāyu*, 60, 146  
*prapaka*, 55  
*prapaka*, *prathama pūka*, 113  
*prasūda*, 82, 88, 91, 98, 100  
*prasūda pūka*, 83, 85, 106  
*prasūda*, *poṣaka dhūtus*, 172  
*Praśastapāda*, 10  
*Praseka*, 143, 170  
*praseka*, salivation, 94  
*prathama pūka*, 55, 56  
*prathama pūka*, *prapaka*, 113  
*pratiḥarinisīrā*, 81  
*Pravīhana*, 160, 170  
*pravīhana*, dysentery, 94  
*pravīhikā*, 151  
*pravara*, 121, 173  
*Pravara bala*, 173-74  
 priority and posteriority, *paratva*-  
*paratva*, 10  
*Prīṣha śūla*, 140  
*prīthaktva*, separateness, 10  
*prīthvī*, 9, 56  
*prīthvī paramāṇu*, 56  
 Pudentitis *medhrapāka*, 155  
 pulse vibration, *dhmāna*, 103  
 pungent, *kaṭu*, 56  
*puriṣa*, 86, 88, 131-32, 151, 153  
*puriṣadhāra*, 51  
*puriṣadharā kāla*, 86, 87  
*puriṣadhāra*, pelvic colon, 52  
*puriṣa*, faeces, 85  
*puriṣamī*, 87  
*puriṣamī* of *annakīṭa*, 87  
*puruṣa*, 4  
*Puti*, 141  
*putigandha*, 30  
*Putigandhi nihśvāsa*, 159  
*Putimānsa*, Gangrene, 155  
*Putisukra*, 158  
 pylorus, 46, 47

**R**  
*rāgakṛt*, 34  
 rage, 111  
*rajas*, 3, 6, 8, 21  
*rajas*, energy, 4, 5, 7, 8  
*rajas* of *Śāṅkhya* system, 21  
*rajoguṇa*, 3, 8  
*rakta*, 11, 30, 31, 82, 97, 101-2,  
 105, 121, 130, 132, 141, 157,  
 175  
*raktadhūtu*, 85, 88, 89, 102  
*raktagni*, 82  
*raktamokṣaṇa*, 102  
*Raktapitta*, haemorrhage, 155  
*rakta*, red, 153  
*raktasaya*, 51  
*raktavaha srota*, 106  
*raktavaha srotamī*, 79  
*rañjaka*, 27  
*rañjakagni*, 28, 89  
*rañjaka pitta* 79, 80, 89, 90  
*rañjana*, colouration, 23  
*rasa*, 11, 38, 41, 56-58, 69, 70,  
 82, 89, 101-2, 105, 129, 155,  
 175

rasa dhātu, 88, 89, 98, 102  
 rasādi dhātu, 84, 91, 101  
 rasāgni, 82, 85, 89  
 rasaprapti 81  
 rasarakta, 174  
*Rasaśopana*, 133  
 rasa stravana, 102  
 rasavaha srotas, 106  
 rasavāhini, capillary, 77  
 rasa tanmātra, 8  
 rasavyanyāḥ, lymphatic, 105  
 rasīyani, 77, 99, 105  
 Rashes, kṣeṭha, 155  
 rājī, 22  
 reals, *tattvas*, 9  
 red-bone-marrow *sarakta-medas*, 90  
 redish, aruna, 153  
 red, rakta, 153  
 repertory, *niketa*, 77  
 resistance to disease and decay, ejas, 122  
 respiration, *ueehūsa-nihīvūsa*, 175  
 retas, semen, 124  
 Ring worm, *dadru*, 155  
 rogādhishhāna, 99  
*Regiprajanana*, 156  
*Remaharṣa*, 143  
 root, mūla, 124  
 rūkṣa bhejīns, 174  
*Rūkṣatruka*, 157  
 ruṇavartī, 30  
 rūpa, 6, 7, 144  
 rūpa, colour, 10  
 rūparātanmātra, 8

S

Sabda, 6  
*Sabda pravala udgāra*, 139  
 Sabda-tanmātra, 8  
*Sabdaśat* ( Noisy ), 141  
 sadana, 112, 143  
 Sūda, asthenia, 155

sūdhaka, 27  
 sūdhakāgni, 28  
 sañcitas, 75, 85  
 sahaja, 120  
 sahajakṛmis, 116  
*Sahaja kṛmis*, intestinal flora, 114  
 sajñīya, 74  
 sajñīya tejas, 17, 171  
 sajñīya tejas aṁśas, 175  
 saṅkāśrita kūmaṭa, 32, 33  
 saṅkīrt, 86, 87, 121, 131, 151  
 saṅkīrt, feaces, 65  
 Śaṅkīrt, stool, 129  
 saliva, *śhīvana*, 60  
 salivation, *praseka*, 94  
 sama, 94  
 samāgni, 96  
 samāna, 65, 66, 148  
*Samāna vāyu*, 61, 62, 93  
 Sambhīnna, 141  
 saṅghāṭabheda, 25  
 saṅgraha, 43, 44, 68, 76  
 Samhatattva, 150  
 Samhatattva, consistency, 151  
 Samhitā, 24, 33, 35, 82, 126, 130  
 saṁhitā granthas, 83, 84, 91, 98, 106, 114, 131, 144, 153, 171  
 Sāṁkhyā, 3, 5, 56, 170  
 Sāṁkhyā Kārikā, 3  
 sāṁkhyā, number, 10  
 Samkēta, 156  
 Samprāpa, 158  
 samprāpti, 97  
 Samprāptasamprāpti, 77  
 sāmya, 4  
 sāmyāvasthā, 4  
 samyoga, 11, 14, 21, 81  
 samyoga, conjunction, 10  
 sañcēṭraṇa, 146  
 Sancayaduḍavēṣana, 142  
 Sandhi śūla, 158

saṅga, 108  
 santarpa, 94  
 Santataruk, 158  
 Santoṣa, 143  
 Saphena chardi, 139  
 Sapraṇihika, 142  
 Sapraṇihika mala pravṛtti, 141  
 Sāra, 26, 27, 30, 43, 50, 75-77, 79, 87  
 sūrabhāga, 27, 63  
 Sarāga, 157  
 Sūrakīṭṭa-vibhūjana, 133  
 sarakta medas, red-bone-marrow, 90  
 Śarat, October and November, 145  
 Śarīra bala, 120, 174  
 Śarīraeēhīndra, 77  
 Śarīra-dhūtis, 83, 89, 91  
 Śarīra madhya, 50  
 Śāringadharā, 28, 29  
 Saruk, 142  
 sarvaceffūsu opratighāta, 121  
 Sareva rasagṛddhi, 143  
 Sañcūla granthi, 158  
 Satkāryavāda, 3  
 sātmya, 150  
 sattva, 3-5  
 Sauhityāsahā, 143  
 Scabies, pāmā, 155  
 secretin, 39, 40  
 semen, retas, 124  
 Semi solid, 130  
 separateness, pṛthaktra, 10  
 Simmond's disease, 48  
 sine-qua-non, 120  
 sīra, 79, 101, 103-4, 147  
 Śīraḥ sīla, 159-60  
 Sirākandārā, 174  
 Sirā stambha, 156  
 sirās, veins, 104  
 Sirōgaurava, heaviness of the head, 94  
 Śīlīra, 174  
 Śīlīra-February and March, 145  
 Sīta, 57

Śītajvara, 143, 160  
 Śītakāla, 145, 174  
 Śītapiṭṭa, 160  
 skatol, 64, 85, 116  
 skin diseases, kuṣṭha, 155  
 śleṣmā, 154  
 ḥeṣman, mucoid excretions, 85  
 Śleṣma sāṁśṭita mala, 141  
 smaśru, beard, 86, 88  
 smaśruḍoṣa, 156  
 smegma and vaginal discharges, prajanana mala, 86  
 smell, Gandha, 153  
 snāyu, 147, 156  
 sneha, 30  
 Snigdha, 130  
 snigdhabhōjīn, 145, 174  
 snigdha mala, 141  
 soma, 22  
 soma, amla, 22  
 ūṣa, 117  
 ūṣāna, absorption, 97  
 sour, amla, 56  
 sparśa, 6  
 Sparśasaha, 160  
 sparśa-tanmītra, 8  
 sparśa, touch, 10  
 Sphurana, 156-57  
 Sphuṣita teak, 157  
 spleen, pīthā, 30, 51  
 splitting, bhinna sāṁghāta 23  
 Śrama, 160  
 srotas, 79, 97, 99, 131  
 srīlo, 61  
 srotāna, 99, 100, 104-5  
 srotānīsi, 36, 77, 79, 82, 83, 97-104, 106-8  
 srotānīsi-capillaries, 105  
 srotānīsi of majū, 106  
 srotoduṣṭi, 108-9  
 srotorodha, 107-8, 117, 155  
 sroto vaigunya-kha-vaigunya, 107

sr̄ga mātra, 130  
 Staimitya, 143  
 Stambha, 134, 157  
 Starling, 62, 66  
 sterobilinogen, 31  
 sterobilinogen, malarañjaka pitta, 152  
 sthāna, location, 77  
 sthāna samīkṣaya, 107  
 sthāna of rakta, 79  
 sthānika dhātu, 117  
 sthānika pitta, 108  
 sthānika vāyu, 145  
 sthāyi-dhātu, 82, 84, 85, 108, 117, 118, 122, 174  
 sthāyi māmsa dhātu, 174  
 sthāyi, posya dhātu, 117  
 sthāyi rakta dhātu, 89, 90  
 sthāyi rasadhātu, 89, 105  
 sthīvana, 146  
 sthīvana, saliva, 60  
 sthīvana, spitting, 143  
 sthūla, 97  
 sthulabhatas, 8  
 Sthulamūla parvaja arumīsikā, 156  
 Sthūlāntra, 51  
 Sthūlatā, 158  
 Stimita Keṣha, 140  
 Stoka, 142  
 Stomatitis, ḫyāpāka, 155  
 stool, fākṛ, 129  
 strenth, bala, 122  
 Strīvaharṣaṇa, 143  
 strong, bali, 145  
 succus-entericus, 42  
 Suciivedhavatavedanā, 143  
 ūta, 94, 130, 134, 160  
 sulphide 64  
 ūkla netra, 158  
 ūkra, 82, 156, 158  
 ūkradhātu, 85  
 ūkragñi, 82, 85  
 ūkra sañcaya, 158  
 ūkṣma, 17  
 ūktapāka, 112-13, 140  
 ūktapāka, Fermentation, 133  
 ūktateva, 112-13  
 ūkṣka, 152  
 ūkṣka, Dry, 141  
 ūryatoka, 12  
 ūrya pāka, 11  
 ūpta roak, 157  
 ūpti, 156  
 ūkṣka jihvā, 160  
 Suśruta, 22, 26, 28, 29, 33, 35, 42, 47, 51, 52, 60, 68, 72, 73, 90, et passim.  
 Suśruta Saṁhitā, 25, 28  
 ūtrashāna, 24, 82  
 ūtravat nādī, 160  
 ūvāeha, 41  
 ūvarabheda, 143  
 ūvāsa, 149, 170  
 ūvāsa, dysponea, 94, 140, 146  
 ūvāsakṛcchra, 159-60  
 ūvāsa pravāsa, 149  
 ūvātha, 149  
 ūveda, 130, 143, 148, 158  
 ūveda, sweat, 85  
 ūveta purīṣa, 141  
 ūvetavareas, 131  
 ūveta, white, 153  
 ūvitra, Leucoderma, 155  
 ūweet, madhura, 56  
 sweat, ūveda, 85  
 ūvīsa, Brown, 141  
 ūvīsa, grayish blue, 153  
 ūvīsa pīta, 130

T

tañjasa, 72  
 Tālūṣepa, 94, 156  
 takra, 116  
 tamas, 3-5, 7, 8, 156  
 tāmasūhamīkāra, 56

*Tamas*, faintness, 155  
*Tāmasika ahamkāra*, 5  
*Tandrā*, 143, 159  
*Tandrā*, drowsiness, 155  
*tanmātrā*, 6-8  
*tanmātric system*, 8  
*Tanuk chardi*, 139  
*tanu*, 152  
*Tanu praseka*, 140  
*Tanu*, thin, 141  
*tantumāt*, 152  
*Tantumāt purīṣa*, 141  
*tap*, 23  
*tap cīvara*, 23  
*tap dūhe*, 23  
*tapana*, 175  
*tapana*, heat production, 23  
*Tarkasamgraha*, 11  
*tattvas*, 3  
*tattvas*, reals, 9  
*tejas*, 6-12, 16, 17, 21, 56, 170  
*tejas*, *agni*, 15, 20, 21  
*tejas*, energy, 122  
*tejaskṛt*, 34  
*tejas* of the sky, 12  
*tejasparamāṇu*, 9, 11  
*tejas sārīra*, 12  
*temperature*, *Uṣmopādāna*, 175  
*thyroxin*, 90  
*fīka*, 25  
*fīkīna*, 30, 93  
*fīkīñgī*, 46, 94-97  
*fīkīñatā*, 43  
*tikta*, 67  
*Tilakatāka*, Black mole, 155  
*tilapīṭṭa*, 131  
*tilapīṭṭa*, gingili cake, 131  
*tilapīṭṭanibha vāreas*, 33  
*tiryaggamana*, 13  
*Tīrataruk*, 157  
 to cause lustre, *prabhakara* 23

*Toda*, 134  
*Tonsillitis Galafundika*, 155  
*Top*, 58  
 Touch, *sparsa*, 10  
 Tovey, F. I., Dr., 47  
 transformation, *parīptti*, 23  
 transient, *anitya*, 12, 57  
*tridoṣa*, 92, 96  
*triguna*, 3, 4  
*Trika ruk*, 142  
*trīḍi*, 35  
*tripti*, 129, 143  
*Trīḍi*, 159  
*Trīḍi*, Thirst, 140  
*Trīḍi*, 133  
*Trīḍi*, thirst, 143  
*tryanukas*, 10, 18  
*tryptophen*, 88  
*trypsin*, 48, 49  
*tubes*, *nāḍī* 77  
*Tudana*, 157  
*tulya*, 43  
 Tumour, *arbuda*, 155  
*tunica intima*, 104  
*Tvak*, 157  
*Tvak gaurava*, 158  
*Tvak-Varna-parivartana*, 160  
*tyrosin*, 88  
**U**  
*uechvīsa-nihīvīsa*, respiration, 175  
*udāna*, 146  
*udara gaurava*, 160  
*udaragaurava*, heaviness of abdomen, 94  
*udaraguha*, 50  
*udara rega*, 47  
*udara trdhva bhāga sādhmāṇa*, 159  
*udara vīpāṭana*, 142  
*udūsarta*, 94

Udayana, 10, 11, 13  
*Udgūra*, 133  
*Udgūra*, eructation, 60  
 Umesha Mishra, 10  
*unḍuka*, 52  
*unḍuka* region, 116  
*unḍuka* region, ileo-cecum, 115  
*Upādāna dhūtūrūpa vāyu*, 134  
*Upādānakāraṇa*, 26  
*Upajīhvika*, uvulitis, 155  
*Upaniṣadis*, 22  
*urahṣṭha*, 146  
*urdhva*, 121  
*Urdhva-āmūṣaya*, 37-39, 41, 59, 60, 116, 133, 154, 159  
*urdhva bhāsa*, 75  
 urine, *mūtra*, 85  
*uroguhā*, 50  
*Uru-ruk*, 142  
*Uṣṇī*, 26, 98, 122, 124, 141, 147, 149, 172  
*Uṣṇī*, *agni*, 109  
*Uṣṇī*, hot, 10  
*Uṣṇīkṛt*, 34  
*Uṣṇī Parīkṣā*, 147  
*Uṣṇotpūḍana*, 154,  
*Uṣṇotpūḍana*, temperature, 175  
*Uṣṇotpatti*, 144, 149, 172, 174  
*uṣṇī*, 30, 57  
*uṣṇakāla*, 174  
*Utkleda*, 133  
*Utkleṣa*, 159-60  
*Utkleṣa*, nausea, 140  
*Utsāhopacaya*, increas of cheerfulness, 122  
*uttaraguda*, 51, 52  
 Uvulitis, *Upajīhvika*, 155

V

Vācaspati Miśra, 16, 25  
 Vāgbhaṭa, 25-29, 34-38, 42, 43, 47, 52, 60, 61, 68, 72, 76, et *passim*  
*vāgandhyo*, 30  
 Vāraṇya, 143  
 Vaiśeṣika, 15, 17, 19  
 Valīvarṇya, 157  
*vaktra*, 146  
*vaktra*, mouth, 145  
*vaktraśoṣa* 146  
*vamana*, 115, 160  
 Vāṅkṣapūṇa, 141  
 Vāṅkṣaṇa ruk, 142  
*vapīvahana*, omentum, 51  
*Varna*, 150  
*varṇa*, complexion, 122  
*varṇakara*, colouration, 23  
*Varyū*—August and September, 145  
*Vasanā*—April and May, 145  
*vasti*, bladder, 51, 52  
*Vasti śūla*, 142  
*Vastivikṛtti*, 142  
*Vāta*, 94, 95, 139, 153  
*Vāta apraṇītti*, 134  
*vāta*, gases, 85  
*vāṭadi deṣa*, 110  
*vāṭaduṣṭi*, 152  
*Vāta prakṛti*, 151  
*Vāta saṅga*, Retention of gas, 142  
 Vāṭasthāna, 172  
*vāṭanīśvara*, 154  
*Vater*, 54  
*vāyavīya* 85  
*vāyavīya*, 72, 74, 75  
*vāyu*, 9, 56, 63, 93  
*Vāyu-upādāna dravyotpatti*, 134  
*Vedāṇi*, 160  
*vega*, 7

vega, velocity, 10  
 veinules, 104  
 veins, sīrās, 104  
 velocity, vega, 10  
 vibhāga, 11, 14, 21, 81  
 vibhāga, disjunction, 10  
 vibhaktaghanagūtratra, 120  
 vibhu, continuum, 6, 56  
 vibhu, infinite, 56  
 vidagdhāhāra, 41  
 Vidaha, 140-41  
 vīradhi, 117  
 Vīradhi, abscess, 155  
 vāsāmya, 117  
 Vijayarakṣita, 25, 111-12  
 vījātīya, 17, 74  
 vījātīya tejas, 17, 105, 171-72, 175  
 vījātīya tejas, oxygen, 147  
 vījala, 152  
 vījala, Slimy, 141  
 Vījnānabhikṣu, 6  
 vīkṣepana, 102  
 vilakṣana guna, 73  
 vilakṣana-tejah-samyo, 11, 17  
 vīpūka, 55-57, 68, 69, 71, 172  
 Vipluta, 141, 153  
 Virūpa prajanana, 156  
 vīrya, 56, 57  
 vīsa, 110, 112  
 vīsam, 112  
 Viśamāgni, 94, 95, 97, 140  
 Visarpa, 157  
 Visarpa, cysipelas, 155  
 Viśaya-tejas, 12  
 viśiṣṭa, 43, 45  
 Visphoṭaka, 157  
 visragandha, 30  
 Viśtambha, 160  
 Viśtambha, constipation, 141-42

vitre 48,  
 Viṭ saṅga, ( Retension of faeces ), 142  
 vivandha, 160  
 Viśarṇatā, 156  
 Viśidhūśitapītiya, 82  
 vive, 48  
 vīraṇa, 117  
 vīddhatrayī, 68  
 vīkka, kid-neys, 51, 52  
 vīḍhikṣamatva, 120, 172  
 vīḍkarana, 23  
 vīḍna, 146  
 vīḍna vīḍyu, 98  
 Vyaṅga, Freckless, 155  
 vīḍpāra fākti, 122  
 vīḍyāma, 120, 144-45, 149  
 vīḍyāmafākti, 120, 149, 154, 172, 174  
 Vīyomavatī, 10  
 vīyutpatti, 100

**W**

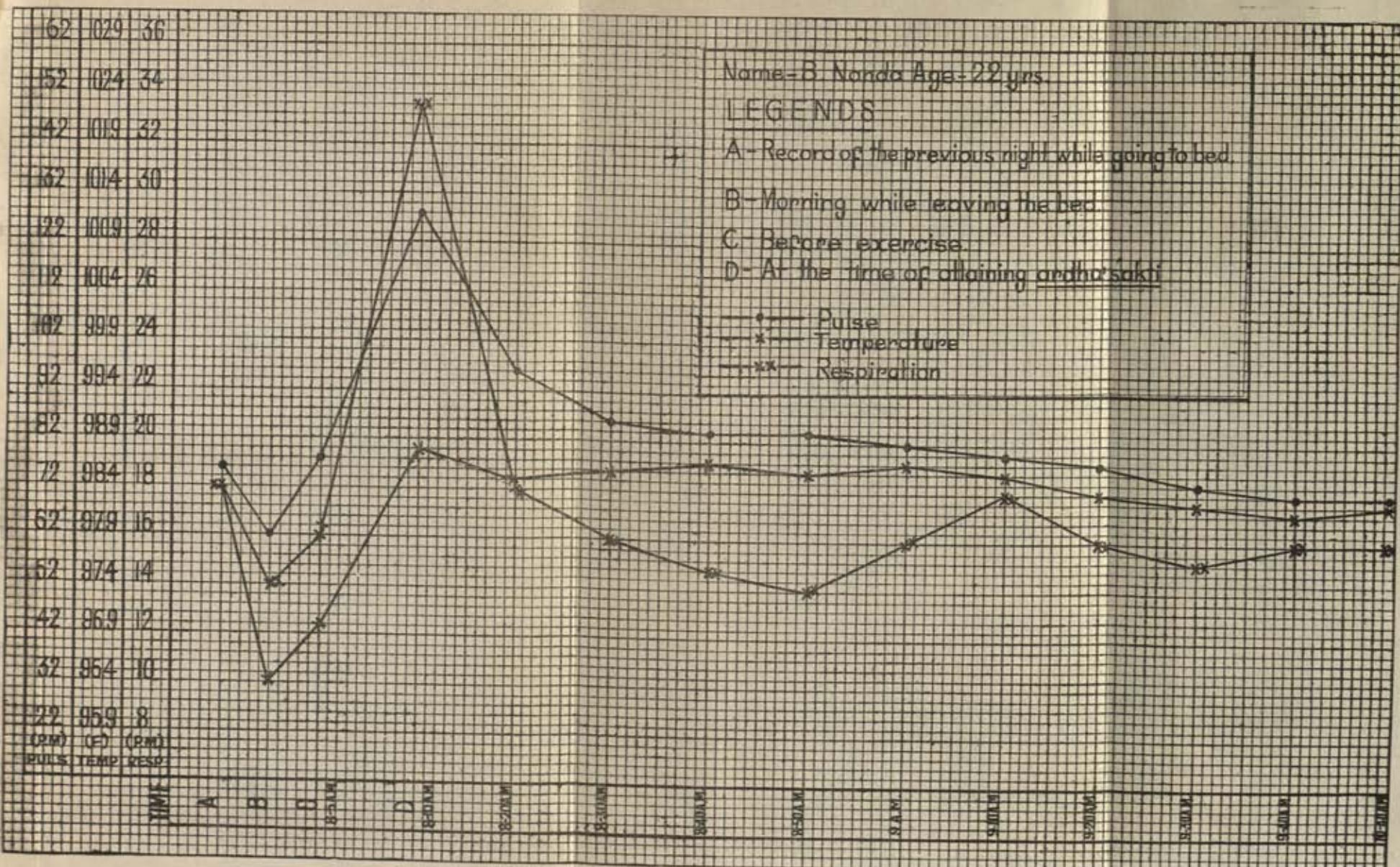
Warts, kīla, 155  
 waste products malas, 98  
 wasting, kṛṣāṅgata, 155  
 waxy excretions from the ear karna-mala, 85  
 weakness of the body, gūṭra sadana, 94  
 Weisz, 49

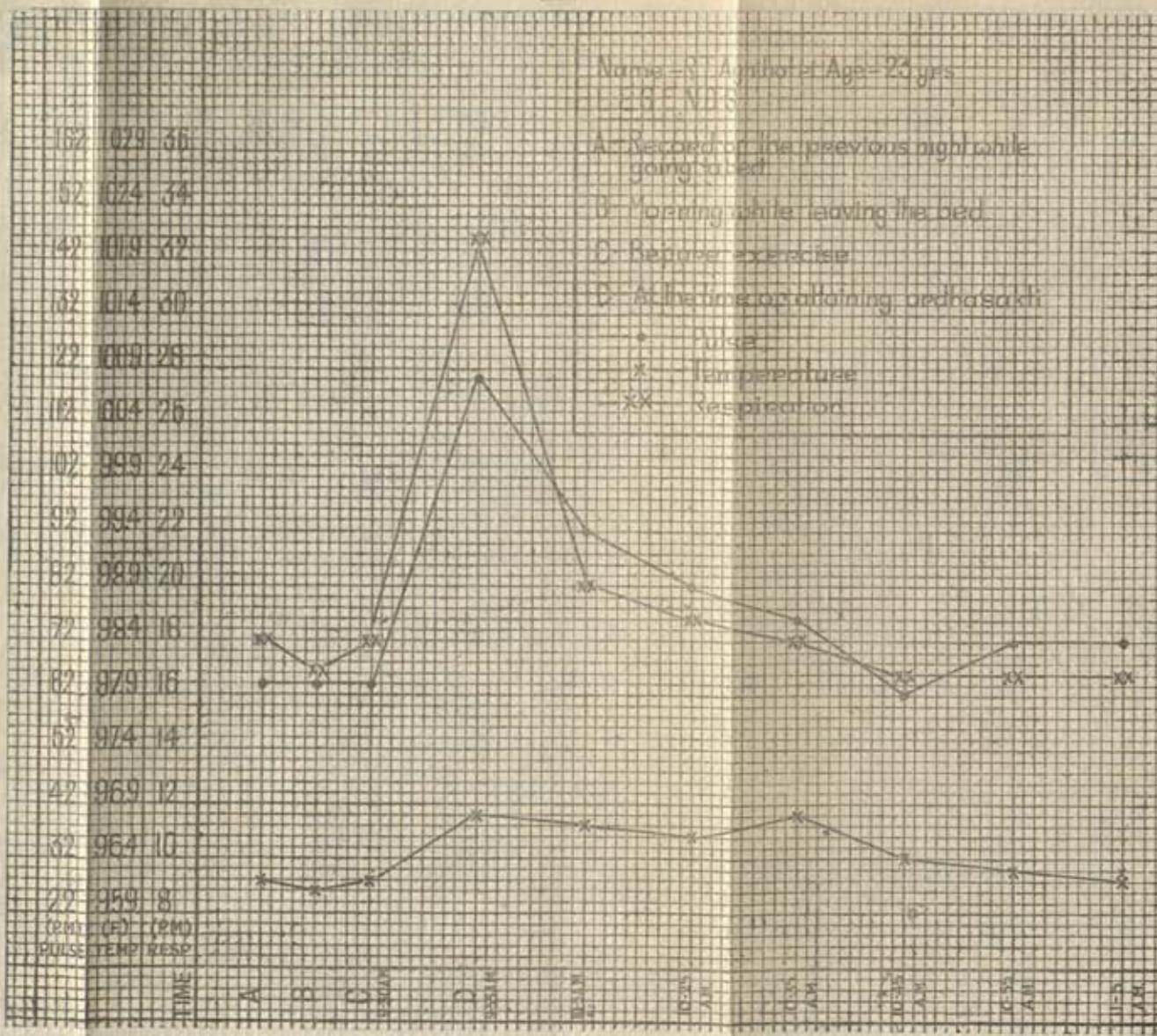
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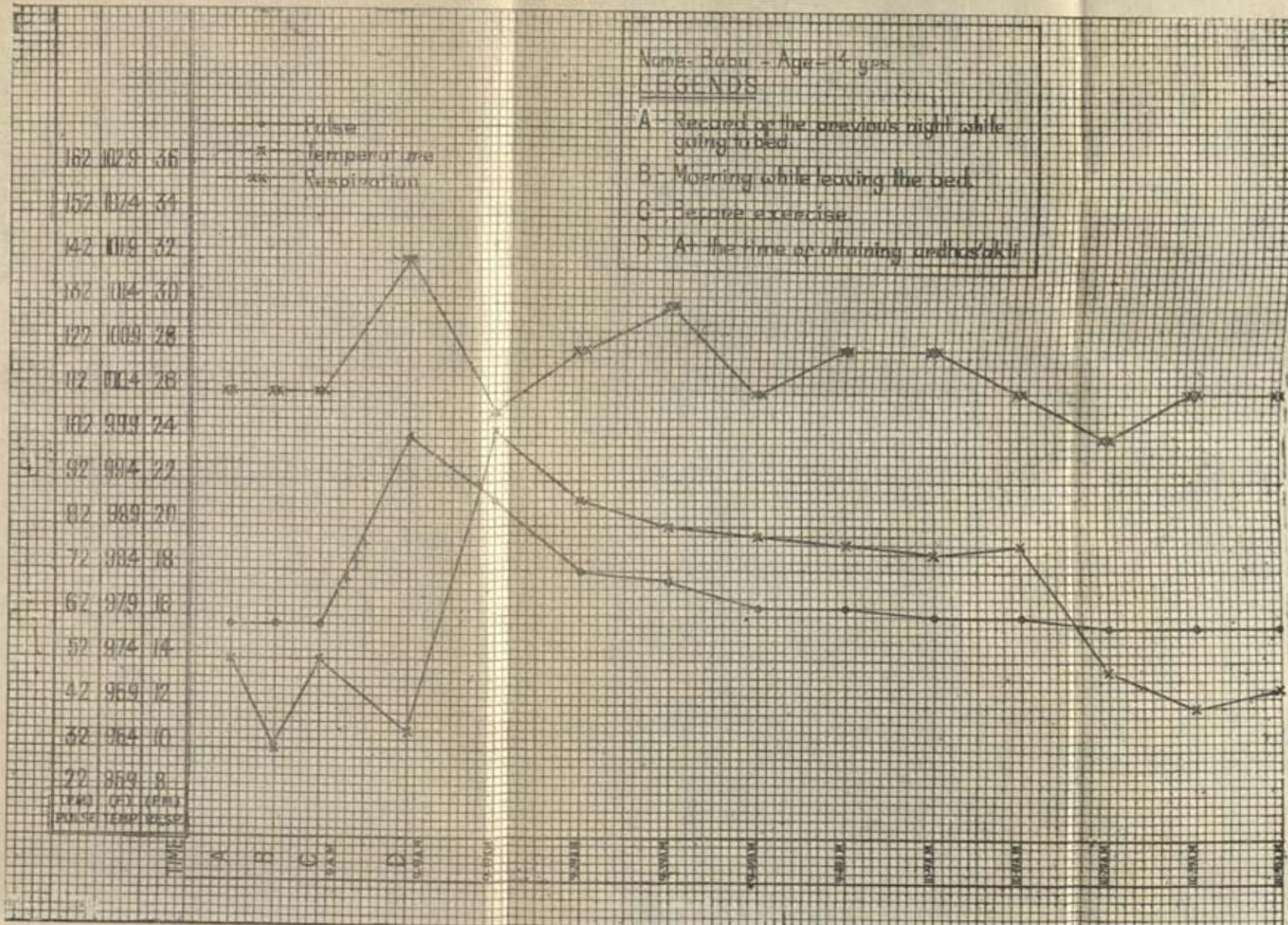
White, śveta, 153  
 Worms, kṛmis, 154

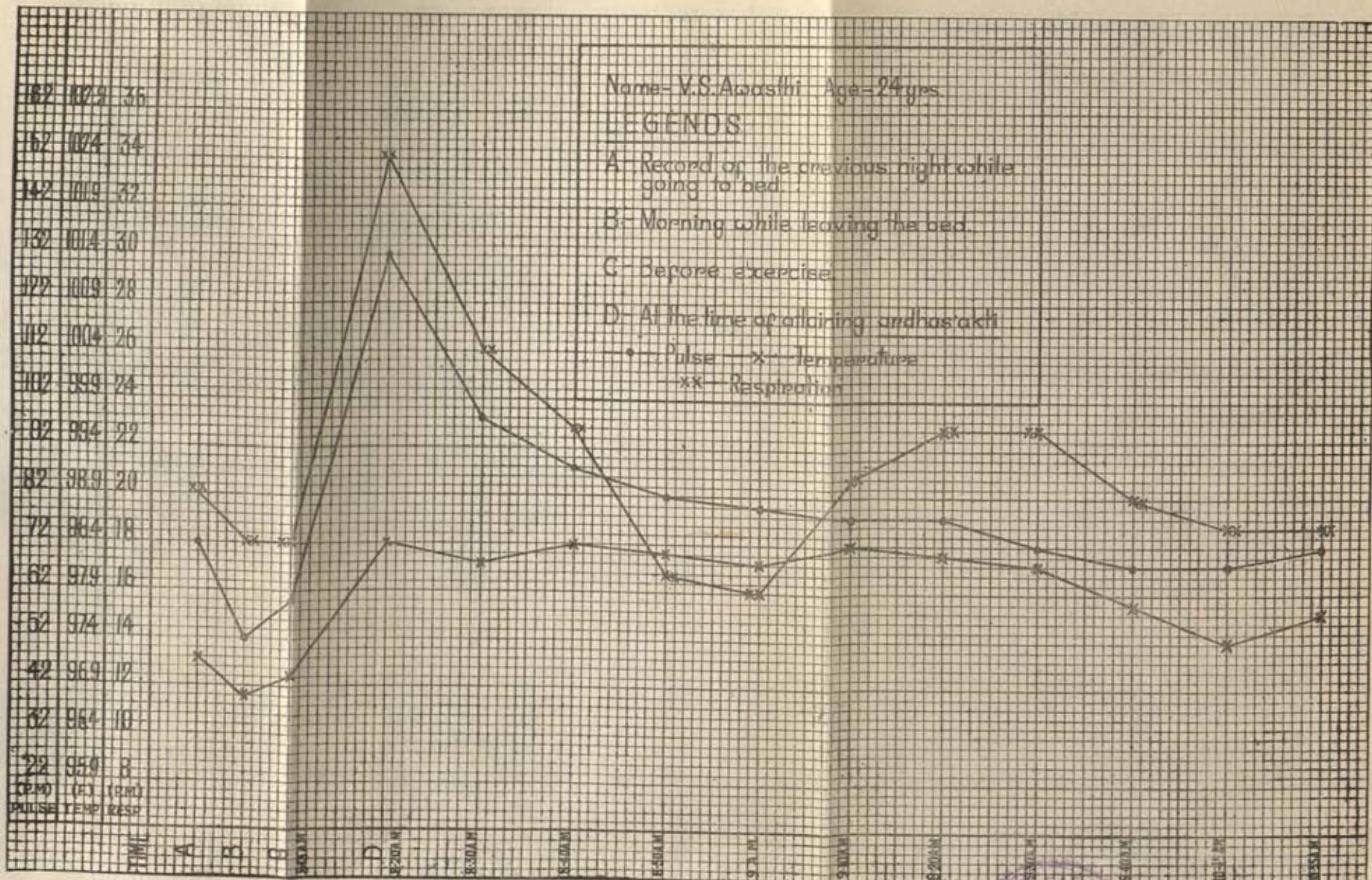
**Y**

yakṛī, 30, 74, 79-82, 88, 132  
 yellow, pīta, 153  
 Yogānandanātha, 68  
 Togarātnikara, 122, 129  
 Togasūrtika, 6  
 Tuktikṛta, 120











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